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ABSTRACT

Designed as an analytic, exploratory inquiry into the manner in which preservice elementary school teachers make sense of their early science teaching performances, this study focused on how teachers exhibited a capacity for understanding pedagogy. Specifically, it concentrated on the reflective process as it occurred in the context of clinical supervision. The study took place in an elementary science methods course. Methods students taught science lessons to fourth, fifth, and sixth grade students in a Calgary, Alberta elementary school. The lessons were audio-taped and transcribed for analysis and clinical supervision techniques were used for the analysis of the lessons. Data indicated that preservice teachers can reflect, given the proper situation, and that the theoretical context of a methods course can be used for the reflective and diagnostic analysis of actual teaching. The concept of the cycle of reflection is also explored and implications for teacher education programs that promote reflection are noted. Transcripts of a lesson on environmental factors and a discussion of the lesson by the clinical supervisor and the teacher are appended. (ML)

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"DETECTING REFLECTION-IN-ACTION AMONG PRESERVICE TEACHERS ENROLLED IN AN ELEMENTARY SCIENCE METHODS COURSE"

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by

Allan M. MacKinnon

A THESIS
SUBMITTED TO THE FACULTY OF GRADUATE STUDIES
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CALGARY, ALBERTA
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THE UNIVERSITY OF CALGARY

FACULTY OF GRADUATE STUDIES

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies for acceptance, a thesis entitled "Detecting Reflection-in-Action among Preservice Teachers Enrolled in an Elementary Science Methods Course" submitted by Allan M. MacKinnon in partial fulfillment of the requirements for the degree Master of Science.

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ABSTRACT

This study begins with concerns about the experience education students have in undergraduate teaching methods courses. Methods courses have had a reputation of being too "theoretical" and of little value to preservice teachers. Position statements in the literature are clear and increasingly specific in recent years about making the blend of theory and practice in methods courses operational. But the empirical studies that are reviewed yield unhelpful and conflicting results, judged by the investigator to be partly due to an inadequate view of knowledge about teaching, and partly due to inadequate conceptualization of what it takes to orchestrate the blend.

To help deal with the matter, a conceptualization of the interface between theory and practice is presented. This, together with a brief review of other notions about the character of knowledge in education, provides the background for the theoretical framework of the study.

The study took place about a practical teaching exercise that occurred in an elementary science methods course. Methods students taught science lessons to grade four, five and six students in a Calgary elementary school. The lessons were audio-taped and transcribed for analysis by the methods students and the investigator. Techniques of clinical supervision were used for the analysis of the lessons. Thus, the study concentrates on the clinical supervision discussion that took place between the investigator and each methods student who taught.

The study draws on a conceptualization of the nature of professional knowledge called "reflection-in-action," put forth by Donald Schön. The research problem is to determine whether this conceptualization is applicable, and appropriate, to studying the way in which methods students make sense of the practical teaching experiences offered in methods courses. Schön's ideas are taken to the context of teacher education, and an analytical scheme for applying the categories of reflection-in-action to clinical supervision dialogue is proposed.

A conceptualization of the "cycle of reflection" is developed, and a "clue structure," or set of criteria, for detecting reflective activity in clinical supervision dialogue is put forth. The use of the clue structure is illustrated with a detailed analysis of the clinical supervision discussion with one of the methods students.

The analysis shows that Schön's ideas are useful in thinking about the way in which preservice teachers make sense of their initial teaching experiences. Moreover, the data show that a preservice teacher can reflect, given the proper situation, and that theoretical content of a methods course can be used for the reflective and diagnostic analysis of actual teaching.

The concept of the cycle of reflection is explored for its potential to provide a new microstructure to clinical supervision that aspires to conceptualizing and provoking reflection among preservice teachers. In addition, questions are raised for further research involving the application of Schön's ideas to teacher education. Finally, implications are derived for a teacher education program that would be designed to promote and to study reflection among preservice teachers.

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This thesis is dedicated to

my father

DR. ARTHUR HUGH MACKINNON

and to my mother

MARGUERITE HELEN MACKINNON

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Chapter 1

FOCUS OF THE STUDY

This study is regarded as an analytic, exploratory inquiry into the manner in which preservice elementary school teachers make sense of their early science teaching performances, particularly how they display a capacity for understanding pedagogy that would allow them to improve their practice over time. The technical term for the particular kind of thinking the investigator seeks to detect is "reflection-in-action," a term put forth by Donald Schön in his recent and promising conceptualization of the nature of professional thinking.

The study took place in a methods course field experience, wherein education students were given opportunities to teach science lessons to children in an elementary school. The research problem is to determine whether Schön's conceptualization of reflection-in-action is applicable, and appropriate, to studying the way in which methods students make sense of their teaching performances. This has entailed the development and assessment of a "clue structure" for detecting reflection-in-action.

Beyond the theoretical perspective provided from Schön's work, the study invokes techniques of clinical supervision -- both as a vehicle within which to embed the substance of the methods course and the analysis of teaching, and as a means of recovering the contextual richness of classroom phenomena. Thus the study is focused on the reflective process as it occurs in the context of clinical supervision. Further, the approach entails the analysis of clinical supervision dialogue, and indeed interviews with five methods class students in the supervisory setting have been examined.

This document is presented in five chapters. In the remainder of Chapter One, the concerns which gave rise to the study are discussed, the significance of the study is put forth, the choice of treatment and conceptual orientation are justified, and the data collection and analysis procedures are described. Chapter Two consists of a review of the literature dealing with the matter of elementary science teacher education, and serves to demonstrate the uniqueness of this research study. In Chapter Three, the elements of reflection-in-action that comprise the theoretical framework are explicated and set against a brief review of other notions concerning the nature of knowledge about teaching. Chapter Four is a report of the analysis and findings, which demonstrate how reflection-in-action can be detected in the supervisory dialogue between the methods class students and the investigator. Finally, in Chapter Five the study is reviewed and the findings and their limitations are discussed.

Justification for the Study

The Development of Teacher Concerns

In order to establish the context for the study, it is helpful to consider a conceptualization by Fuller and Bown (1975) regarding the process of becoming a teacher. According to this conceptualization, beginning teachers typically change their "teacher concerns" as they move through preservice to inservice teaching (pp. 38-39):

> Preteaching concerns - Fresh from the pupil role, education students who have never taught are concerned . . . about themselves. They identify realistically with pupils, but with teachers only in fantasy. They have not experienced the realities of the teaching role. Education courses which deal with the teacher's realities seem to them "irrelevant." The identification with pupils manifests itself at the beginning of observation, when they are often unsympathetic, even hostile, critics of the classroom teacher whom they are observing.

> Early concerns about survival - At first contact with actual teaching, however, education students' concerns change radically. Their idealized concerns about pupils are replaced by concerns about their own survival as teachers. They are concerned about class control, their mastery of the content to be taught, and evaluations by their supervisors. They wonder if they will ever learn to teach at all. This is a period of great stress.
>
> Teaching situation concerns - Concerns about limitations and frustrations in the teaching situation, about the varied demands made on them to teach, not just survive, are added on to self-concerns. Education students who are teaching now become concerned about methods and materials which were the focus of education courses taken previously. They find they learned content well enough to reproduce it on an exam but not well enough to explain it to someone else, to answer questions, or to give examples.
>
> Concerns about pupils - Preservice teachers express deep concerns about pupils, about their learning, their social and emotional needs, and about relating to pupils as individuals. But they may be unable to act on these concerns. Flooded by feelings of inadequacy, by situational demands and conflicts, they may have to lay aside these concerns until they have learned to cope with more urgent tasks, such as being heard above the din.

In previous empirical work with student teachers, Fuller (1969) found no evidence to support the proposition that beginning teachers are concerned with instructional design, methods of presenting subject matter, assessment of pupil learning or tailoring content to individual pupils. Yet these matters are typically dealt with before student teaching in education courses. Although her study involved education students only during their practicum experiences, Fuller drew insightful implications for their methods courses (p. 219):

> Information about concerns during this pre-teaching phase may actually be of more interest to many teacher educators than information about concerns during student teaching. First actual teaching, though stressful, is generally reported to be of more interest and benefit than other experiences offered in teacher education programs. Lack of interest is a problem before, rather than during student teaching.

The practical problem occurring in methods courses, as pointed up by this conceptualization, is not unfamiliar. Education students selectively attend to matters that are of more concern to them than the theoretical perspectives of their instructors, namely, whether they will be liked by their students, be able to control a class, or survive in the teaching community. Those are the "preteaching concerns" and "early concerns about survival." An important task for teacher educators may therefore be to help preservice teachers overcome their self-concerns so that they might develop concerns about pupils. Furthermore, teacher educators might strive to create practical contexts to assist methods students in understanding theoretical perspectives about teaching methodology.

Assuming that the development of teaching situation and pupil concerns is associated with actual classroom experience, a logical approach toward a solution of this problem would likely entail the inclusion of field experiences in methods courses, wherein education students are given opportunities to teach children in the school setting. The premise underlying the argument is that actual teaching experience within, not after, the methods course will accelerate the development of preservice teachers' concerns about the learning of children. Moreover, these experiences would provide contexts within which to embed the study of teaching methodology in the methods course itself.

Significance of the Problem

Certainly, questions about the nature of the experience that preservice teachers receive in the practical component of their methods course are as important as questions about whether or not the experiences ought to be there, if not more so. This investigator recognizes the need for a contextualist view of teaching that is rich enough to allow beginning teachers to understand the effects of their teaching on the learning of children. And, as documented in Chapter Two, there is little research that deals with this matter in the area of elementary science teaching.

But the significance of the study has yet another dimension. Implicit in its conceptual foundation is the assumption that a particular kind of thinking about one's teaching practice will enhance the process of becoming a teacher. Not only is there a need for a practical context in which methods course material can be embedded, but there is also a need for methods students to understand that context. Here, reflection-in-action is regarded as the method by which one acquires this understanding; it follows that there is a need for an appropriate conceptual framework that will drive it, detect it, and allow investigators to research it.

Clinical Supervision

Clinical supervision has been utilised in this study for guidance in the development of the methods course. It provides a model of supervision upon which the practical component of the methods course was based. In addition, its method of analysing teaching fulfills the requirement of an overall view of teaching that is rich enough to put all of the methods course instruction in context.

Since its conception in the fifties, clinical supervision has taken many forms. There is little consensus among major writers about what the supervisor ought to do, or how he should proceed. Weller (1971) admits that ". . . instructional supervision is a poorly defined and inadequately conceptualized process. It has grown and fragmented under pragmatic pressures and diverse orientations" (p. 4).

> The functions of the supervisor appear to be separable into three areas, that may be called counseling, teaching and training. Although there is some overlap, operational distinctions are evident. These functions represent a multidimensional continuum: from emphasis on personal adjustment to emphasis on understanding instructional

> phenomena, to emphasis on specific teaching behaviors; and from concepts derived from social and counseling psychology, to those derived from educational and cognitive psychology, to those derived from training and behaviorial psychology. (pp. 7-8)

When approaching the literature on clinical supervision, it is essential to recognize that how one views the process of supervision depends largely on how one views the world of teaching. The latter is much more than a vantage point, clearly laden with assumptions and values held deeply within individuals. Thus, the supervisor's approach to supervision may vary widely in terms of the parameters of instruction examined as well as the method of examination. Methods of analysing teaching have included

> . . . the unconnected inventory of events (sometimes called 'checking off the laundry list of faults'); the analysis of critical incidents, or 'successive trauma technique'; the analysis of patterns of events with suggestions for improvement; and the selective pattern approach, in which the focus is upon a small number of salient patterns both educationally important and realistically amenable to change. (pp. 18-19)

The latter method of analysis -- pattern analysis -- and its theoretical foundations are central to this study. That the practice of a teacher is at least in part a reflection of his or her conceptual "tool box" lies at the heart of this epistemology of teaching. Rather than modeling the type of behavior sought in the teacher, or teaching the teacher something academic and "hoping," the supervisor engaged in pattern analysis pays close attention to the relationship between the teacher's inferred conceptual make-up and his or her observed practice. The teaching performance is seen to depend on what the teacher "knows" about the subject, about children, and about teaching.

Another basic premise underlying clinical supervision is that teaching is observable behavior -- what the teacher does and what the students do as they interact in the classroom. Further to this, teaching behavior is patterned; it shows repeating characteristics, each being laced with both explicit and implicit messages for students, and each being associated with certain pupil consequences. Mosher and Purpel (1972) outline the important implications of this foundation (p. 80):

> If teaching is characterized by regularity rather than randomness, it can be classified and studied in the same ways as are other intellectual and social phenomena. The assumption that teaching is organized is obviously essential to any analysis of teaching, whether clinical analysis in supervision, or formal research investigation. Clinical supervision also assumes that teaching behavior should be conscious, rational action. Both the children's learning and the teacher's craftsmanship will increase as it becomes more so.

A few examples adapted from Goldhammer (1969) will help clarify what is meant by teaching behavior patterns, implicit messages held within those, and the associated pupil consequences (pp. 12-13):

Teaching pattern	Implicit message	Pupil consequence
Whenever a pupil gives a response, the teacher repeats his response verbatim.	There is no point in listening to anyone in here other than the teacher, because he will say everything eventually.	Pupils do not listen very closely to their peers.
Whenever a pupil gives a response, the teacher elaborates the response.	The pupil can never really win. No matter how hard he tries to frame a response, the teacher will always be able to do it better.	Pupils give short, unsophisticated responses to the teacher's questions. The teacher will do the work for them.
The teacher responds to almost every pupil's recitation with a stereotyped, "O.K., very good."	Anything goes.	The pupils' responses are shot from the hip.

It is important to recognize, however, that classifying teaching behavior, then inferring incidental learnings and pupil consequences, is a matter of reducing the complex events of classrooom interaction to apparently cut and dry behavioristic connections. As Goldhammer put it (pp. 13-14),

> Whether or not such incidental learnings actually result from the patterns of teaching described is an empirical question for which, obviously, I cannot offer a conclusive answer. Neither can I assert that in response to any given pattern of teaching behavior, the incidental learnings will be the same for everyone or for any individual from one time to the next. And finally, although my examples make it seem that way, there is little reason to suspect that patterns of teaching behavior will always exist in one to one correspondence with simple incidental learnings. On the contrary, multiple learnings can, theoretically, derive from the same stimuli in any number of combinations and hues of reinforcement.

While casting classroom events in such a manner is recognized as being problematic, this investigator would argue that it may be no more problematic than any account or explanation of classroom events. But the value in analysis of this nature is not found in the strength of knowledge claims about the implicit messages and pupil consequences of certain teaching patterns. Rather, it is in the logical feasibility of the inferences, plus the habit of searching for them. This investigator intends to make the case that Schön's conception of reflection-in-action provides a sophisticated conceptualization of such a habit.

The Supervision Cycle

The analysis is embedded in three phases of the clinical supervision cycle: the prior statement, or plan of objectives, content and pedagogy; the instruction proper; and an after-the-fact analysis of the effect of teaching. The technique insists that the analysis be rational, always beginning with the data -- the recorded lesson. The supervisor and teacher share their perceptions of the domain of classroom events that both have witnessed, and that is on paper in front of them. Each bringing their experience, knowledge and "professional feel" to bear on the situation seen in the lesson, they negotiate about practice and compare their "teaching notes." Thus, pattern analysis proceeds and, eventually, the prescription to change a salient feature of the teaching comes about. A more desirable pupil consequent is identified and defended, and means of obtaining it are discussed.

The scheme of pattern analysis is regarded as providing an overall view of teaching that is rich enough to put all of the methods instruction in context. There are three further reasons for choosing clinical supervision as the treatment in the study. First, its primary objective is the improvement of instruction, focusing on what and how teachers teach as they teach. Second, it is concerned with how the teacher makes sense of actual teaching experience. Finally, as it involves confronting the teacher with evidence of actual teaching, it is regarded as a powerful method for developing the teacher's reflective capacity -- the foundation, it is assumed, for effecting improvement in practice.

Conceptual Orientation

Of particular interest to this investigator is what might be regarded as the "right blend" of educational theory and practice in teacher education. The place of theory in practice, and vice versa, has long been debated in faculties of education, and yet students of education continue to grieve about courses which, to them, are "too theoretical." In the previous section, a mechanism for merging theory in the practical component of a methods course was put forward. The idea has been to provide methods students with experience with which they might make better sense of the theoretical perspectives of their methods instructor.

The task pursued here is to present a conceptual orientation toward theory and practice that will be helpful in thinking about the place of theory in the practical experience of the methods course. In addition, this conceptual orientation toward theory and practice will help pave the way for the theoretical framework of the study which is developed in Chapter Three.

The Theoretic and the Practical

Much of the conceptual orientation of this study begins with the work of Joseph Schwab. In The Practical: A Language for Curriculum (Schwab, 1970), he develops and applies to the field of curriculum the Aristotelian distinction between two domains of human activity: the "theoretic" and the "practical."

Theoretic activities are those which seek general, or universal knowledge which applies to large classes of occurrences. Practical activities, on the other hand, seek out decisions for action which apply to unique situations. As Schwab argues (p. 3),

> Decisions are never true or trustworthy. Instead, a decision (before it is put into effect) can be judged only comparatively, as probably better or worse than alternatives. A decision . . . has no great durability or extensive application. It applies unequivocally only to the case for which it was sought.

Going further, Schwab draws attention to the disparity between the subject matter of the theoretic and the practical (p. 3):

> The subject matter of the theoretic is always something taken to be universal or extensive or pervasive and is investigated as if it were constant from instance to instance and impervious to changing circumstance.

> The subject matter of the practical, on the other hand, is always taken as concrete and particular and treated as indefinitely susceptible to circumstance, and therefore highly liable to unexpected change.

The theoretic and the practical also differ in regard to the source of the problems to which they attend. While theoretical problems ". . . arise from areas of the subject matter marked out by what we already know as areas which we do not yet know" (p. 3), practical problems arise from ". . . states of affairs in relation to ourselves" (p.3).

Finally, activities of the theoretic and the practical differ irreconcilably in their method (p. 3):

> The principle of theoretic enquiry determines the general shape of its problem, the kind of data to seek, and how to interpret these data to a conclusion. In the theoretic . . . the formulation of a good specific problem and the devising of the right experiment may challenge wit and reward genius, but the direction in which the experiment is to go and what is to be done with data, once collected, are dictated by (the) guiding principle of the enquiry. (parenthetical addition)

According to Schwab, the practical has no such guide or rule, although its method can be thought of as occurring in two phases. In the first of these, a practical problem is made out of a particular state of affairs -- not of mind. It comes about in a search for data ". . . which is only gradually given direction by the slow formation of the problem" (p. 4).

> At some indeterminant point along the way, as the problem assumes shape and the data search becomes more clearly directed, the character of the process alters. It becomes more of a search for solutions and less of a search for the problem. In this second phase, we envisage alternative actions, consider their possible consequences, and estimate their cost and feasibility. (p. 4)

Thus, theoretic and practical human affairs differ, according to Schwab, in terms of (1) the ends, or outcomes, which they seek, (2) the subject matter that they regard, (3) the source of their problems, and (4) their methods.

The distinction between these two domains of affairs leads Schwab (1971) to conclude the following (p. 494):

> Theories of curriculum and of teaching and learning cannot, alone, tell us what and how to teach, because quesions of what and how to teach arise in concrete situations loaded with particulars in time, place, person, and circumstance. Theory, on the other hand, contains little of such concrete particulars. Theory achieves its theoretical character, its order, system, economy, and, above all, its very generality only by abstraction from such particulars, by omitting them.

The incongruity of theory and practice is further complicated by the fact that theory necessarily provides a narrow, or incomplete view of its subject by pointing out only certain features of phenomena while ignoring others. And, since every theory has its own narrow outlook on reality, pluralities of theory arise, ". . . no one member of a plurality complete, each member throwing its own useful light on the subject treated" (p. 494).

What is required to "heal" the incompleteness of any one theoretical view of a practical situation is, according to Schwab (p. 494),

> . . . recourse to temporary and tentative bridges built between useful parts of bodies of knowledge in the course of their application to practical problems.

In order to conceptualize this "healing process," Schwab proposes what he refers to as the "arts of the eclectic" (p. 503). The end sought by eclectic activity is a "synthesized view" of the events of practical affairs, based on multiple theoretical views and the understandings that they hold. In order to clarify this notion, it will be worthwhile to turn, next, to a conceptualization of the "interface" between theory and practice.

The Interface between Theory and Practice

Following the work of Schwab, Roberts (1980) has proposed a conceptualization of the interface between theory and practice which takes into account the logical, epistemological and ethical elements involved in ". . . moving back and forth between theory and practice" (p. 69). He draws to our attention two reasons why theory cannot find its way directly into practice. First, the choice to follow any line of action is a matter of practical ethics -- not of theoretical consistency (p. 67):

> It is a matter of weighing the relative value of pupil outcomes, and there comes a point in the weighing where further research simply does not help. That is, there comes a point where the teacher simply has to take a stand, and "consistency with research" does not constitute adequate grounds for such a stand.

Second, theoretical perspectives necessarily provide "truncated versions" (p. 68) of the events with which teachers must deal. The conceptual principles of any theory provide the guidelines for perception; they are templates that point us in directions which enable us to see. But while conceptual principles, or theories, provide lenses with which we focus on selected attributes of the generic phenomenon, they also conceal many other attributes which constitute the contextual wholeness of educational events. As Roberts argues (p. 68),

> . . . theoretical accounts of learning are correspondingly different and, what is more, none is complete. That is, no two theories can explain all aspects of a given generic phenomenon equally well. (italics in the original)

Like Schwab, Roberts argues that multiple theoretical perspectives are available to a practitioner, each attending to different aspects of educational phenomena while ignoring others, and each offering different explanations and encompassing different directives for action. But at the interface between theory and practice, the practitioner copes with this multiplicity of understandings, and he attempts to capture the richness of educational phenomena by weighing the various perspectives offered by coexisting theories for them. The synthesized view is one which is based on "informed eclecticism" (p. 71), and it begins with multiple theoretical views and the understandings that they provide. Thus, a practitioner's decision to act is not necessarily based on direct deduction from one theory, but rather on a process of deliberation over the merit, or worthiness, of the outcomes promised by various theoretical perspectives. Roberts summarizes teachers' thinking thus (p. 73):

> Their thinking, in summary, involves (a) viewing each truncated version of the event through multiple and chosen theoretical lenses . . . ; (b) developing a conception of the total event which is as rich as possible, requiring that they consider as many truncated versions as their education and ability permit; and (c) deciding on a defensible course of action. (italics in the original)

Informed Eclecticism and Reflection-in-Action

Taken together, Schwab's and Roberts' work provides a sophisticated view for dealing with a multiplicity of theoretical perspectives in education, as well as their place in practice. Their position also holds a major implication for teacher educators, namely, that the only way for teachers to achieve informed eclecticism is through reflection.

Russell (1984) has recently developed a position concerning the potential of teachers' reflections on their own teaching. He examines Schön's perspective of the significance of reflection in professional practice, and considers its implications for teacher education (p. 28):

> Finally, we have the beginnings of a way out of what I regard as one of the basic dilemmas of teacher education -- the relationship between the university, where teachers are "trained" and "retrained," and the schools, where most teachers practice their profession.

> If the daily work of teachers and student teachers can be removed from its present inferior status, we may find that much of our current work in teacher education can be redirected to exploring the meanings of "reflection-in-action" and, in time, coming to understand the stages through which a teacher moves in learning to reflect-in-action.

Data Gathering and Analysis

Data were gathered about third- and fourth-year students in an elementary science methods course, with whom the investigator was working as a graduate teaching assistant. The class consisted of twenty-eight students and took place during the first term of their professional (student teaching) year. Prior to entering a local upper-middle-class elementary school for the practical component of the course, the technique of pattern analysis was taught to the methods students and a few lesson transcriptions were analysed in class. The methods students were then divided into five groups, each responsible for planning a lesson that was to be taught in the school by one volunteer. The lessons were to be a part of a unit of study dealing with "Environmental Factors," and were to be presented to three grade four-five classes and two grade five-six classes. The lessons were planned accordingly under the supervision of the investigator.

Each lesson was audio-recorded and transcribed, and then discussed in the clinical supervision setting between the person who taught and the investigator. Those discussions were also audio-recorded and transcribed. Thus, the data consist of transcriptions of five lessons and the five discussions of those lessons.

Data were analysed using an approach put forth by Roberts and Russell (1975) in An Alternative Approach to Science Education Research: Drawing from Philosophical Analysis to Examine Practice. Specifically, the elements included in Schön's conception of reflection-in-action are translated here to the context of teacher education, and directly applied to the transcriptions of the clinical supervision dialogue. Chapter Four consists of the data analysis and the proposal of a clue structure for detecting, in supervisory dialogue, reflection-in-action.

Summary

Certainly, educational theoreticians and researchers have provided much knowledge that should be passed on to future teachers. But education students should also be shown the instrumental value of theory in understanding pedagogy. A scheme has been put forward in this chapter that aspires to help education students "find the way" to informed eclecticism by embedding, in the methods course, an opportunity for them to reflect on their own teaching performances. Thus, the practical experience of the methods course, and indeed this study in general, have been designed to make the provision for utilising educational theory in the reflective and diagnostic analysis of practice. Moreover, the design makes the provision to study the reflective process itself. Next, in Chapter Two, these notions are set against a review of the literature dealing with the inclusion of practical teaching experiences in elementary science methods courses.

Chapter 2

REVIEW OF RELATED LITERATURE

Position Statements

A portion of the science education literature deals with recommended standards for preservice teacher preparation. During the past twenty-five years, several position statements have been advanced from prestigious organizations regarding the inclusion of practical experiences in elementary science education programs.

In 1961, the American Association for the Advancement of Science forwarded the following position statement to accompany the post-Sputnik "inquiry science" curriculum movement:

> Professional education experiences for prospective elementary teachers should include opportunity to observe the work of well-qualified teachers who like science and who like children. Prospective teachers should also be provided opportunities to gain experience in formulating questions that are meaningful to children, in developing methods for using quantitative approaches, in using audio-visual and laboratory materials, and in adapting to science instruction materials found in the surroundings of children. (AAAS, 1961, p. 2023)

Nine years later, AAAS published recommendations that were more explicit in the practical experiences they prescribed for preservice elementary education students:

> Guideline VI - The institution, working cooperatively with the schools, should provide experiences with children and schools so designed that the teacher develops the skills required for effective instruction in the science program. (AAAS Commission on Science Education, 1970, p. 25)

> Much of what prospective teachers must learn about teaching will develop out of carefully planned experiences with children and schools. Early experiences of the teacher with children in schools should occur during the first or second undergraduate year when the prospective teacher is enrolled in science and other courses which provide background for his future career. These early experiences may involve in-class observations and part-time work as a teaching aide but many of them should be simulated experiences presented by film or video-tape and designed to focus attention on particular science teaching strategies that he might use as critical points in the lesson. The observations and simulated classroom episodes should be followed by opportunities for students to teach science lessons; first with one child in a tutorial, later to a small group in a microteaching format, and finally in a self-contained classroom or as a member of an instructional team. Many opportunities should be provided for the student and the professional staff to evaluate the student's teaching performance. (pp. 23-24)

Similar recommendations were published in 1983 by the National Science Teachers' Association:

> Standard IIa - Science Teaching Methods: Preservice elementary teachers should be required to complete a minimum of one separate course of approximately three semester hours in elementary methods. This course should be scheduled after the content courses have been completed and just prior to student teaching.
>
> Standard III - Field Experiences: Preservice elementary teachers should have opportunities throughout their undergraduate years to teach science to children in schools. These field experiences in science should begin with observations and tutoring and proceed through small and large group instruction. Student teaching must include experiences in planning and teaching science. (NSTA, 1983, p. 66)

In the discussion of the NSTA recommendations, there is a position promoting the inclusion of science teaching experiences within the methods course.

> The techniques of science instruction are best learned through practice. Preservice elementary teachers must be afforded the opportunity to teach science to children throughout their college careers, preferably in a variety of schools at several different grade levels. (p. 67)

Even in the current literature, this issue has received attention. The Science Council of Canada's recent Report 36 (1984) includes discussion of the preservice teacher education dilemma (p. 57):

> Even though preservice teacher education programs ought to involve many aspects of science education, only a few are feasible. Many aspects of science teaching cannot be taught to teachers-in-training before they have acquired the basic competencies of teaching. One of the major functions of preservice teacher education is to enable the novice to "survive" the first year of teaching. Under such circumstances, students at this stage of their professional growth cannot be expected to master alternative styles of teaching appropriate to different types of educational objectives nor to acquire the skills of self-monitoring essential for teacher growth.

Appropriately, the Science Council's report includes a recommendation that Canadian teacher education institutions continue to address this quandary (p. 57):

> Recommendation #29 - University faculties of education, in consultation with other faculties within the university, ministries, school boards and the teaching profession, should develop and test new models of teacher education with both preservice and inservice components.

The increased amount of explication in the recommended practical experiences for preservice teachers likely reflects the development of innovative ideas and technologies available to teacher educators. One thing is certain, though: concern over the value of preservice education courses has not diminished during the past twenty-five years. If anything, it has increased.

Research

Another portion of the science education literature deals with systematic inquiry which has been conducted into the area of elementary science methods courses and preservice practical experiences. In preparation for the justification of the proposed research, a review of that body of literature is presented here.

After conducting a computer search of the ERIC system, forty-one studies relating to the preservice science methods course experience of elementary education majors were obtained. From those, twenty-five studies were selected for the following review. As a convenient way of organizing those studies, a scheme Roberts and Russell (1975) developed to characterize the trends in science education research methodology was utilised. The review presented below holds to that conceptual format, in the hope of providing an orderly configuration for the reader.

According to the Roberts and Russell scheme, some paradigms in science education research are committed to systematizing observations and collecting "objective" data out of classroom events. Others are devoted to improving student achievement of some sort. Emerging out of the former side of this broad division are two closely related paradigms: the "observation-scheme paradigm" and the "status-study paradigm." Designing instruments for interpreting science education phenomena, and using those to report about states-of-affairs on the scene, are the primary foci of these two schools of research. The latter side of the broad division consists of methods used for searching out ways of making science education better: the "racehorse-study paradigm" involves comparing different methods of teaching with student achievement of some sort; the "what-accounts-for-the-variance paradigm" may compare any number of a host of independent variables to student outcomes with which they are construed to be associated. These four categories cover the experimental end of the research spectrum.

On another front of educational research, a few naturalistic studies dealing with preservice methods experiences can be found emerging in the journals. Thus a fifth category of studies found in this domain is included to cover that end of the research spectrum.

The purpose in this review is not to sort methodologies though. The scheme presented above has been used to sort "findings" which are inherent in and limited by method. Just as the researcher who is devoted to experimental design and statistical analysis is limited by his technique, the ethnographer may indeed be limited by his conceptual configurations. Thus, in reviewing all of the studies presented here, the investigator considers the ideas and intentions of the researchers in addition to their techniques. The emergent sketch of inquiry-to-date in this domain of science education will then serve as a contrast to the problem and approach of the present study.

Observation-scheme and Status-study reports

Carefully designed measuring devices are necessary for the researcher in pursuit of statistically sound data. Kagan and Harty (1979) reviewed a variety of instruments which may be used to employ Stufflebeam's CIPP model ("Content-Input-Process-Product") for evaluating the preservice preparation of elementary science teachers. Instruments for assessing the following types of attributes of preservice teachers are included in the review: demographics, personality type, self-concept, study habits, knowledge of science and the nature of science, knowledge or application of science process skills, application of science-related quantitative skills, acquisition of science knowledge and skills, and concrete and formal reasoning abilities. A total of seventeen instruments are included in the review: several for measuring attitudes of preservice teachers, more concerning program implementation evaluation, others dealing with teaching concerns. The discussion reflects the opinion that in order to study teaching and the preparation of teachers, one must begin with carefully selected instruments (pp. 58-59):

> The proposed evaluation design might help delineate the efficacy of a developing program for the preparation of preservice elementary teachers. The purpose has been to display a design where those involved in such a process may select elements to their needs or use the identified dimensions as "take-off" points. This design may yield

> descriptions and findings about procedures and products from a variety of perspectives; it might also yield judgements about those procedures and products.

Several studies have made use of such instrumentation for reporting about the state-of-affairs in preservice science teacher education. (See Gabel and Rubba, 1979; Osbourn and Taylor, 1983; Shrigley, 1974a, 1974b, 1976; Tamir, 1983a, 1983b; Wolfe, 1977.) Wolfe (1977) identified an apparently serious limitation of using instruments to evaluate the performance of preservice teachers during a field experience conducted in their methods course (pp. 160-162):

> No significant correlations were found between the results of the university methods class activities (as judged by the university instructor) and the measure of successful classroom teaching as determined by the assisting teacher using the LEF (Lesson Evaluation Form), nor by the university instructor who interpreted the results on the form. It was found that observing and evaluating a student teaching is an important factor in measuring teaching performance, as well as contributing to success in the methods course. The results of this study reinforce the need to establish reliable observation forms to rate student teachers' success in teaching science in the classroom. Most of the forms are very general, and only their great similarity from place to place attests to validity. Perhaps it would be more effective to prepare brief observation forms containing statistically reliable items to measure specific science teaching performance. A more fundamental question is whether teaching performance is sufficiently well defined to allow the use of any forms.

This investigator would argue not that teaching performance requires elucidation, but that most evaluation instruments capture the act of teaching only superficially, if at all.

In order to clarify the limitation of using such instruments to examine teaching, moreover to teach beginning teachers how to examine practice, it will be useful to consider a sample instrument. Tamir (1983), unlike most journal authors, provides a sample set of questions from the "Structured Lesson Report Form" which he developed (p. 816):

> The SLRF is completed by the teacher following the lesson. Most items are structured so that the teacher has to select the appropriate option. For example: "Audiovisuals used in class: 1. chalkboard 2. overhead projector 3. slide projector 4. super 8 loop projector 5. 16mm movie projector 6. charts and diagrams 7. preserved plants and/or animals 8. living plants and/or animals 9. other (describe)_________." Certain items are open but carry clear instructions. For example: "Topic of the class ___________ or, What is the kind of homework assigned?____________________."

Other instruments used by Tamir, and indeed most used in this type of research for analysing teaching, have a similar character -- they attempt to capture the essence of teaching by sorting activities of the classroom. Are the students reading, or are they conducting a lab? Is there a lecture or is there a discussion?

The remaining studies which fall into this category are even more peripheral in their inquiry into the preservice methods experience of beginning teachers (see Gabel and Rubba, 1979; Shrigley, 1974a, 1974b, 1976). It seems that a popular avenue of investigation has been to explore the relationship of various methods class experiences to such preservice teaching attributes as attitude, knowledge, or perception of the methods instructor. There is very little in this body of research which speaks either to the quality of preservice methods course experiences or to the manner in which beginning teachers reflect on their developing craft.

Racehorse-study reports

As noted above, studies in this category reflect the desire to link certain methods of teaching with student outcomes of some sort. In the articles reviewed, five studies involved the comparison of various methods course experiences with the developing attitude of preservice teachers (see Albert and Van Der Mark, 1981; Conradson, 1973; Harty, Anderson and Enochs, 1984; Koballa and Coble, 1979; Weaver, 1979).

Harty, Anderson and Enochs (1984) measured attitudes toward science teaching and pupil control ideology of preservice teachers undergoing two different treatments in their science methods courses -- one field-based, the other campus-based. The same science content was utilised for the two treatments and both had an inquiry-process focus. Subjects in the field-based group planned and taught lessons to small groups of children in elementary schools on a bi-weekly basis over three semesters. Results showed that those teachers involved in the field-based program were significantly more "custodial" in their pupil control ideology than those in the campus-based program; however, no significant difference was reported in attitude toward teaching science.

The latter finding is contradicted by Koballa and Coble (1979) who reported that inclusion of "professionally related activities" in a biology laboratory course for preservice elementary teachers resulted in increased favourable attitudes toward teaching science. The inconsistency of these research findings leads one to question their value. How is it that practitioners can rely on such generalizations?

Other studies involved the pitting of various methods class experiences against the development of teaching competencies among the students (see Bluhm, 1979; Conradson, 1973; Dillishaw and Yeany, 1982; Harris, 1970; Perkes, 1971; Pettus, 1981; Symington, 1979). Much of the research of the late sixties and early seventies reflected an interest in the value of microteaching experiences. For example, Steinbach and Butts (1969) investigated the relationship between teaching peers or teaching children during microteaching, and the development of teaching competencies. Results showed no significant differences between the two treatments in any of the performance criteria except in the pacing of lessons.

Apparently those who taught children took longer to explain lesson activities during the initial sessions of the program. In addition to those findings, the authors reported that students who received feedback from experienced teachers achieved significantly greater gains in subsequent evaluations of their teaching performance by, presumably, the same experienced teachers.

Harris, Lee and Pigge (1970) reported that subjects having at least six microteaching experiences developed significantly better skill in classroom techniques than those having only one experience. "Teaching skills" included providing concrete materials, utilising childrens' observations, allowing children to perform experiments and to develop conclusions, and helping them to verify conclusions. Cast into the Fuller and Bown conceptualization regarding the development of teacher concerns, these findings support the notion that early teaching experiences accelerate the development of concerns about pupils. However they also support the common-place notion that "practice makes perfect."

Dillishaw and Yeany (1982) presented a rationale for the use of strategy analysis to train teachers in the use of selected teaching strategies, and illustrated how teachers can be trained using two schemes of analysis. Teaching behaviors were categorized with extremes defined as "expository/direct" and "inductive/indirect" strategies. The findings suggested that both verbal and non-verbal behavior of preservice teachers can be influenced by the systematic analysis of video-recorded lessons (p. 74):

> When the trainees become proficient in identifying and coding teaching strategies, they teach a lesson to their peers that is designed to bring about selected outcomes by engaging in appropriate teacher/pupil behaviors. The lesson is video-recorded and saved for self-analysis by the student. After the self-analysis, the trainees have been required to teach and analyse a second lesson.

It is interesting to note what "systematic analysis" entailed in this study. The "Data Processing Observation Guide" was developed to describe and measure the occurrence of ten specific operations: collecting, ordering, condensing, preparing, displaying, translating, comparing, expanding, recording and inferring. These activities were then grouped into yet another dimension consisting of three general interactions: directing, explaining and questioning.

While Dillashaw and Yeany's study shows more promise than others in providing opportunities for preservice teachers to examine and improve their own teaching, the method they used for analysing teaching is considered untenable. This investigator would prefer to avoid the possibility of encouraging a teacher to attempt to understand teaching by sorting activities. What is totally ignored in the process is the quality of classroom interactions and their meaning to the teacher and to the pupils. For example, discussions are not necessarily better than lectures, and vice-versa. Merely identifying a teacher's activity as one or the other clearly makes no comment about quality.

What-accounts-for-the-variance reports

Studies which fall into this category are very similar in character to those reviewed above. First, they rely on instrumentation and statistical analysis. Second, they compare various methods course experiences with preservice teacher attributes of some sort -- attitudes, concerns, teaching competencies, etc. Their distinguishing characteristic has to do with their regard for how some preservice teachers differ from others: do male teachers develop significantly higher attitudes for the teaching of science? does the age of the preservice teacher influence performance?

Employing the conceptual geography of Fuller and Bown (1975), Cunningham and Blankenship (1979) investigated the development of teacher concerns during movement from non-professional sectors of society, to pre-professional teachers, to professional teachers. The authors sought the relationship between teacher age, teacher expertise, class size, grade level and subject area to the level of self-concern expressed by intern teachers. Intern teacher self-concerns were significantly lower for "self as science teacher" than either "self as reading teacher" or "self as teacher." The older interns expressed lower self-concerns than did the younger. Those who thought they taught reading best expressed lower self-concerns for teaching science than interns who thought they taught other subjects best. Finally, there were no significant differences between either grade level or class size and the level of concern expressed by the interns.

The implications Cunningham and Blankenship drew from their findings deserve attention here (pp. 419-425):

> Whatever the reasons for their responses, it is clear, based on the assumptions of the Teacher Concern Model, that the interns in this study thought that science instruction, and their involvement in science instruction, had little effect on either their survival as interns or their probable success as members of the teaching profession. While this attitude seems to be widespread, it is incumbent on the science educator to make every attempt to modify this attitude. Two strategies avail themselves. First, the science educator could approach the legitimate place of science in the elementary curriculum from the scientific literacy ideal. If carefully implemented, the intern could be led to see the importance of scientific literacy for the twentieth-century student and the twenty-first-century citizen. This point made, it appears to be a simple jump to science instruction.

The Herculean step from data to implications in this study is intriguing to say the least. It may serve as an example not only of the limited utility of such research for improving the state of preservice science education, but also of the manner in which some researchers "read into" their data unwarranted prescriptions for practice.

Dobey and Schafer (1984) examined the relationship between preservice teachers' background knowledge of a specific topic and the "inquiry teaching competency" displayed while the topic was taught. Results showed that no-knowledge teachers needed to initiate student inquiry, allowed fewer student ideas to be investigated, and exerted more control over classroom activities than did intermediate-knowledge teachers. Intermediate-knowledge teachers were confident and did not control student inquiry, nor did they suppress student inquiry in order to express their content knowledge as the high-knowledge teachers did. The study seems to suggest that in order to enhance inquiry science teaching in schools, however that may be defined, the background knowledge of preservice elementary science teachers ought to be curtailed to "intermediate." But this, also, is "reading into" the data an implication which almost seems to follow automatically.

Naturalistic reports

One study relating to the elementary science methods course experience of preservice teachers involved ethnographic methodology. Duschl (1983) employed "participant-observation" techniques in a case study he conducted in a methods course, where he detected the existence of an "antagonistic dilemma" (p. 745):

> Two different approaches to the study of science, one content oriented, the other process oriented, may contribute to the students' confusion, insecurity and avoidance of science. The students' perception that science is learning content, an objective of introductory level science courses, and the science methods class's objective of teaching science as process sets up an "antagonistic dilemma" between the two. Such an "antagonistic dilemma" may be manifest in the lack of instructional time accorded to science by elementary educators. The type of science experiences an individual encounters influences their perceptions. To offset student perceptions developed in science courses which stress principally content, the students need science experiences which truly represent science as inquiry. New strategies for the training of elementary majors in science need to be examined.

Duschl's recognition of confusion, insecurity and avoidance of science among methods class students is not unfamiliar. However his claim regarding the "antagonistic dilemma" is a proposition which, in the paper, one does not see manifest in the methods students' discourse. At any rate, he attended neither to the practical experiences of science teaching to which methods students are exposed, nor to the manner in which they reflect on those.

Summary

The related literature reviewed in this chapter has served to demonstrate the uniqueness of the problem that this research study pursues. Moreover, it has given rise to two major points. First, the value of including practical teaching experiences in elementary science methods courses, which was argued on grounds of plausibility in Chapter One, has been well documented. Position statements advanced from commissions, committees and councils have supported the idea. Second, the majority of research conducted in this area has invoked a fractionated view of teaching. It has been argued that in their pursuit of isolated variables and statistically sound data, researchers have disregarded the contextual character and meaning of the teaching experiences that methods students first encounter. Surely, a study which addresses the reflective process occurring in these experiences would take such contextual considerations into account.

In Chapter Three the conceptual orientation of this study is pushed forward by first establishing a view of teaching that does take into consideration the contextual wholeness of educational events. This will provide the background for the elaboration of Schön's notion of reflection-in-action and the completion of the theoretical framework of the study.

Chapter 3

THEORETICAL FRAMEWORK

Attitudes Toward Knowledge About Teaching

The latter part of Chapter One was concerned with developing a conceptual orientation toward the nature of theory and practice, as well as the interface between the two. In the first part of this chapter, those notions are extended further and set against a modest review of ideas that educators have held in regard to research and, particularly, knowledge in education. This will then provide the background for a complete explication of Schön's conception of reflection-in-action.

Teaching as a Science

It has not been atypical of educational theoreticians to ascribe the status of scientific knowledge to knowledge about teaching. There is, of course, an eighty-year legacy of this particular expectation of educational knowledge, and it has clearly shown itself in the literature reviewed in Chapter Two.

In The Study of Teaching, Dunkin and Biddle (1974) have pulled together what they regard as ". . . the first comprehensive review of research on the activities of teaching" (p. 12). In this review, the authors search for "factual information" about teaching (p. 11):

> Where is the knowledge that should constitute the core of teacher training? Where is the empirically based information that represents the science of teaching? (italics in original)

Although Dunkin and Biddle show some reservations toward those articles included in their review that they deem to be ". . . examples par excellence of dustbowl empiricism . . ." (p. 14), they hold tight the notion that the outcomes of teaching are subject to predictability and control:

> The authors of this book assume that the activities of teaching are reasonable, natural, rational events. They have discoverable causes and effects. Though conducted by human beings who have unique perspectives and aspirations for them, the activities of teaching have an observable, existential reality that is not divergent from any other set of observable events. (p.12)

Gage (1977) has been a major contributor to the notion that a science-like corpus of knowledge can be obtained for teaching. He is careful to view the activity of teaching -- like that of medicine, engineering, and even science -- as a practical art, the end of which is the decision to act in such and such a way in order to solve a practical problem. But Gage wants decision making in teaching to depend, at least in part, on a "scientific basis" (p. 18):

> In medicine and engineering, where the scientific basis is unquestionable, the artistic elements also abound. In teaching, where the artistic elements are unquestionable, a scientific base can also be developed. These professions are not in themselves sciences; they merely have scientific bases. To practice medicine and engineering requires a knowledge of much science: concepts, or variables, and their interrelations in the form of strong or weak laws, generalizations or trends. But using the science to achieve practical ends requires artistry -- the artistry that enters into knowing when to follow the implications of the laws, generalizations and trends, and especially, when not to, and how to combine two or more laws or trends in solving a problem.

The scientific basis, as Gage construes it, seems to provide a plausible approach to rationality in teaching. His claims are consistent with the approach taken in psychology of education, measurement and evaluation and teacher effectiveness. That the work of doctors and engineers relies heavily on science, no one would argue. Nor would they argue about the artistry of practical affairs. Why not apply the rigor of science to producing and using knowledge in the field of education?

It will be well to pause and reflect on such practical affairs as medicine and engineering, and those of education. There may be many differences between the former two and the latter, but two very significant disparities are suggested here. The first has to do with how we determine whether goals have been accomplished. Engineers invent, design, and build things that we use; doctors make people better; and teachers educate people. Engineers can predict and measure the strength of a bridge, and doctors can read electrocardiograms and take blood counts. Quantifying the phenomena of interest to those professions has been relatively unproblematic, and the knowledge applied to their manipulation of worldly things surely has a scientific character. But for those of us in education, whose ends are states of mind, there is no microscope that allows us to see thought, no scalpel that can enter the mind. The basis upon which teachers make decisions is highly interpretive; at best, we can rely on something in a child's behavior or performance that can be construed to be "indicative" of a state of mind. Even the most reliable multiple choice exams provide scores that are only indicative of something in the mind. Neither doctoring nor engineering is as vague.

The second disparity lies in a fundamental difference between the response of "objects" in science (engineering and medicine) and those in education. Bluntly put, children are not seeds. They have a character and a will that influence their behavior and minds. Their response in the classroom is not at all like the mindless response of a seed to water, of concrete to sulphate-rich soil, or of a heart to acetylcholine.

The response of a child to, say, a teaching strategy, is much more complex and ambiguous than a response in the world of science. And since children are active agents in their behavior, performance and states of mind, they depend on the meaning of "stimuli," or "variables," not only their presence.

Teaching as an Art

Other authors have objected to assigning scientific status to knowledge in education. Many hold the view that to seek objectivity in classroom phenomena is to reduce the complex character of educational life. Eisner (1984), who has been a major proponent of this view, writes (pp. 151-152):

> Because the realities of the classroom and of social life in general are, at best, an array of qualities for which meanings are construed, they will always present more to the perceptive teacher than propositional language (the language of science) can ever capture. Theory in science cannot, I suggest, even in principle, replicate the qualities of life as it is lived. And yet it is these qualities upon which subtle pedagogical decisions must be made. (parenthetical addition)

With the belief that teaching in classrooms is ideographic in character, and that the features of classroom life are not likely to be explained or controlled by behavioral laws, Eisner refutes the view of educational knowledge that counts on scientific epistemology. He looks on knowledge in education as a means by which one acquires "appreciation," meaning an awareness and an understanding, of what one experiences in the classroom. In his writings about educational evaluation, Eisner (1983) argues for this expectation of educational theory (p. 7):

> Theory plays a role in the cultivation of artistry, but its role is not prescriptive, it is diagnostic. Good theory in education, as in art, helps us see more. It helps us think about more of the qualities that constitute a set of phenomena; theory does not replace intelligence and perception and action, it provides some of the windows through which intelligence can look out into the world.

Thus, knowledge in education, for Eisner, is far from scientific in character. Speaking to the capacity of scientific methods for producing knowledge in education, he writes the following (p. 3):

> Because scientific assumptions and scientifically-oriented inquiry aim at the search for laws or lawlike generalizations, such inquiry tends to treat qualities of particular situations as instrumentalities. The uniqueness of the particular is considered "noise" in the search for general tendencies and main effects. This, in turn, leads to the oversimplification of the particular through a process of reductionism that aspires towards the characterization of complexity by a single set of scores. Quality becomes converted to quantity and then summed and averaged as a way of standing for the particular from which the qualities were initially derived. For the evaluation of educational practice and its consequences, the single numerical test score is used to symbolize a universe of particulars, in spite of the fact that the number symbol itself possesses no quality that expresses the quality of the particular it is intended to represent.

Eisner's view of knowledge in education -- a means to apprehend and appreciate complexity in classrooms -- illustrates a particular view in the philosophy of science. Where theories are substantiated by their fruitfulness in practice, that is, their economy and instrumental utility in predicting and explaining states of affairs, the thinking of the "instrumentalist" is evident. Of course, Eisner would not have educational knowledge predicting and controlling classroom life; he would rather have it used to understand, explain, or appreciate that life. But it is the functional element in Eisner's conception of knowledge which is instrumentalist in character: theories provide a view of the world. This kind of thinking has been captured by the writings of Hanson (1958), among others, who formulated an analysis of theories wherein "Physical theories provide patterns within which data appear intelligible" (p. 90). In accordance with Hanson's views, observation itself is "theory-laden," and all notions of causality concern a certain form of conceptual organization.

Going further, Eisner's (1983a) thinking regarding educational knowledge is also "relativistic" and "eclectic" in nature. About these views, he writes the following (p.14):

> . . . it might be useful to state as clearly as possible what I mean by relativism. I gladly accept the label relativist *if* the term refers to someone who recognizes that different theoretical systems regard different phenomena as data, that what constitutes evidence is determined by the theoretical system with which one operates, and that conclusions about reality cannot be dissected from the theoretical and methodological procedures used to generate those conclusions.
>
> I also accept the label *eclecticist* if the term refers to the belief that there is not now, nor is there likely to be, any single theoretical view that will encompass the whole of reality, and that therefore, the best we are likely to do is to draw from a variety of theoretical systems the kinds of guidance that when employed eclectically will be helpful in our daily work. I also accept the label *instrumentalist* if it refers to the idea that the adequacy of a set of ideas is most usefully determined by what they enable us to do. (italics in the original)

Other authors display instrumentalist thought in their writings about knowledge in education. For example, Bolster (1983) argued, in *Toward a More Effective Model of Research on Teaching*, that knowledge of teaching has two basic characteristics (p. 298):

> First, it is *ideographic* in origin and therefore *particularistic* in character; that is, this knowledge arises from the need to comprehend the complexity of a particular context with sufficient accuracy to be able to act efficaciously in it. Second, teachers' knowledge of teaching is validated pragmatically. Principles are believed to be true when they give rise to actions that "work." (italics in original)

Bellack (1981), speaking to the relationships between educational research findings and teaching practice, also exposes instrumentalist characteristics in his thinking. Referring to the products of qualitative, or interpretive research, he writes the following (p. 69):

> The findings of such inquiries are not generalizations that apply across many teaching situations, but rather, accounts of participants' interpretations of specific classrooms, and explications of the assumptions that underlie these interpretations. These accounts

> obviously do not furnish explicit rules for practice; rather they provide teachers with "intellectual instrumentalities" (Dewey's term) to guide them in observations and interpretations of events in their own classrooms.

Practical Knowledge

A recent school of thought about knowledge in education does not rely so heavily on the conventional view of theory in practice. At its foundation this school has the notion that teachers hold and use "practical knowledge," which is contained in, and bound by, what they do in their professional activity. Practitioners are seen to display more than they can talk about in their day-to-day work. Much of what makes up this practical knowledge and understanding is tacit, and there is no dichotomous separation of knowing from doing. Rather, the teacher's knowledge grows out of doing and responds to practical needs that require lines of action.

Elbaz (1981) displays these beliefs in The Teacher's "Practical Knowledge": Report of a Case Study. Her thinking seems to be similar to Eisner's in regard to the role of theoretical knowledge in practical affairs, and she does leave a little room for teachers to "borrow" knowledge from the various disciplines (pp. 43-71):

> Deliberative process is the main way in which practical knowledge is examined in terms of its adequacy to particular problems, but intuitive and reflective processes that focus on general issues, goals and beliefs are likely to be equally important.
>
> Phenomenological sociology . . . is helpful in speaking of the knowledge that structures our unexamined reality. The teacher's knowledge can be viewed as a special case of the everyday knowledge we all possess.

But the teacher is viewed by Elbaz as an agent who chooses among theories in the process of deliberating over lines of action in a particular situation. The following passage is perhaps more illustrative of the instrumentalist character of this thinking (p. 59):

> The teacher's view of theory may range from outright rejection -- for example, the teacher who sees himself as a pragmatist working by trial and error in the classroom -- to deliberate single minded application of a particular theory -- for example, the teacher who is inspired by Piaget. In between there is a teacher who feels that theory is relevant but remote, or difficult to use. Such a teacher may draw on theories of practice rather than on strictly theoretical formulations. Whatever the teacher's position, his stance with respect to theory determines what kinds of theoretical knowledge he will draw upon and how he will us it in particular situations.

Drawing from Schwab, Elbaz argues that although decisions are unique to their circumstances, the means by which they are obtained involves a process of "deliberation": the application of "rules of practice," "practical principles" and "images."

> The rule of practice is simply a brief, clearly formulated statement of what to do or how to do it in a particular situation frequently encountered in practice.
>
> The practical principle is a broader, more inclusive statement than the rule. Practical principles embody purpose in a deliberate and reflective way. For example, the statement of a principle enunciates, or at least implies, the rationale that emerges at the end of a process of deliberation on a problem. (p. 61)

The level of "images" in the practical knowledge of teachers is an over-arching category on which both rules of practice and practical principles depend (p. 61):

> On this level, the teacher's feelings, values, needs, and beliefs combine as she formulates brief metaphoric statements of how teaching should be and marshals experience, theoretical knowledge, and school folklore to give substance to these images. Images serve to guide the teacher's thinking and to organize knowledge in the relevant area. The image is generally imbued with a judgement of value and constitutes a guide to the intuitive realization of the teacher's purposes.

The teacher's practical knowledge, then, is a repertoire of both articulate and tacit means for making sense of classroom life, and it has a great deal to do with what the teacher will do in a particular situation.

Summary

In the preceding discussion three platforms regarding the nature of educational knowledge have been presented. The sequence of presentation has been characterized by a movement from the "reliance" on theoretical knowledge to respect for practical knowledge; from a view of theory which entails control and prediction, to one which entails understanding; and from the separation of knowing from doing, to interrelatedness. Of course, the literature reviewed here to demonstrate the diversity in ideas educators hold about knowledge in education is but a small sample of the literature available. It will, nevertheless, provide the background for the presentation of Schön's ideas, which is undertaken next.

Reflection-in-action

In The Reflective Practitioner: How Professionals Think in Action, Donald Schön (1983) has presented a conception of "knowledge-in-action," which is comparable to Elbaz's notion of practical knowledge. In setting the parameters for his epistemology of practice, he first challenges the opposing school of thought regarding the nature of practical knowledge -- what he calls "Technical Rationality" (p. 21):

> According to the model of Technical Rationality -- the view of professional knowledge which has most powerfully shaped both our thinking about the professions and the institutional relations of research, education and practice -- professional activity consists in instrumental problem solving made rigorous by the application of scientific theory and technique.

Schön refutes the notion that a science-like corpus of knowledge can "drive" practice, and that it can lead to predictability and control in practical affairs (pp. 48-49):

> Among philosophers of science no one wants any longer to be called a Positivist, and there is a rebirth of interest in the ancient topics of craft, artistry and myth -- topics whose fate Positivism once claimed to have sealed. It seems clear, however, that the dilemma which afflicts the professions hinges not on science per se but on the Positivist view of science. From this perspective, we tend to see science, after the fact, as a body of established propositions derived from research. When we recognize their limited utility in practice, we experience the dilemma of rigor or relevance. But we may also consider science before the fact as a process in which scientists grapple with uncertainties and display arts of inquiry akin to the uncertainties and arts of practice.

In reconsidering the nature of professional knowledge, Schön honors the practical competence of professionals in divergent situations, and searches for ". . . an epistemology of practice implicit in the artistic, intuitive processes which some practitioners do bring to situations of uncertainty, instability, uniqueness, and value conflict" (p. 49).

> When we go about the spontaneous, intuitive performance of the actions of everyday life, we show ourselves to be knowledgeable in a special way. Often we cannot say what it is that we know. When we try to describe it, we find ourselves at a loss, or we produce descriptions that are obviously inappropriate. Our knowing is ordinarily tacit, implicit in our patterns of action and in our feel for the stuff with which we are dealing. It seems right to say that our knowing is in our action.

Like Elbaz, Schön is more interested in the process of professional decision making than in the decisions themselves. He conceives of "reflection-in-action" as a means by which professional knowledge is put into play, in terms of both "problem setting" and problem solving (p. 40):

> In real world practice, problems do not present themselves to the practitioner as givens. They must be constructed from the materials or problematic situations that are puzzling, troubling and uncertain.
>
> When we set the problem, we select what we will treat as the "things" of the situation, we set the boundaries of our attention to it, and we impose upon it a coherence which allows us to say what is wrong and in what directions the situation needs to be changed. Problem setting is a process in which, interactively, we name the things to which we will attend and frame the context in which we will attend to them. (italics in the original)

According to the model of reflection-in-action, when a practitioner sets a problem in a situation, he surfaces "fundamental principles" that are ". . . closely connected both to his frames and to his repertoire of exemplars" (p. 317). For Schön, fundamental principles represent theory, or conceptual apparatus, in use. When the practitioner goes about his work, he engages in a "reflective conversation" with the situation. Past experiences are brought to bear on the situation; frames are imposed and bring to attention certain aspects of phenomena; problems are set and actions that entail certain solutions are formulated. What the practitioner "sees" in the situation depends fundamentally on his conceptual make-up and the way in which his reflection proceeds. The "fundamental principles" Schön conceptualizes appear to be equivalent to Elbaz's notion of "images," in that fundamental principles surface from and influence the situation seen by the practitioner in his day-to-day work.

Referring back to clinical supervision for a moment, it is plausible that problem setting is one of the activities in which the supervisor and the teacher engage, as they discuss the observed lesson. As the discussion proceeds, and the teacher confronts new representations of his or her classroom practice, he or she is faced with a new task. The supervisor must, as Schön would say, reframe the problematic situation (p. 129):

> The teacher (supervisor), who attributes the student's predicament to his way of framing the problem, tries to make sense of the problematic situation he is encountering at second hand. The situation is complex and uncertain, and there is a problem in finding the problem.
>
> Because each practitioner treats his case as unique, he cannot deal with it by applying standard theories or techniques. He must construct an understanding of the situation as he finds it. And because he finds the situation problematic, he must reframe it. (parenthetical addition)

The second element of reflection-in-action consists of experiment, played out to discover what consequences and implications can be made to follow from the reframed problem (p. 131):

> In order to see what can be made to follow from this reframing of the situation, each practitioner tries to adapt the situation to the frame. This he does through a web of moves. Within the larger web, individual moves yield phenomena to be understood, problems to be solved, or opportunities to be exploited.

Finally, reflection-in-action involves a reflexive interchange between the practitioner and the situation (pp. 131-132):

> But the practitioner's moves also produce unintended changes which give the situation new meanings. The situation talks back, the practitioner listens, and as he appreciates what he hears, he reframes the situation once again.

It is worth pausing once again to recall the clinical supervision cycle. Consider the teachers, discussing with their supervisor, the effects of identified teaching patterns in their practice. It is reasonable to suspect that, providing they have the reflective capacity to do so, these teachers will come to new understandings of the effects of their teaching practice. The process of clinical supervision could be said to involve a three-way "reflective conversation" among the teacher, the record of his or her teaching, and the supervisor.

Schön would prefer to speak of the reflective process as being cyclic in character (p. 132):

> In this reflective conversation, the practitioner's effort to solve the reframed problem yield new discoveries which call for new reflection-in-action. The process spirals through stages of appreciation, action, and reappreciation. The unique and uncertain situation comes to be understood through the attempt to change it, and changed through the attempt to understand it.

Beyond the matter of coming to appreciate and understand classroom events in a "new light," the reflective practitioner engages in moves that have to do with the choice of action that will be taken. These moves comprise the rigor of the practitioner's "on-the-spot experimenting" (p. 141):

> When the practitioner sees a new situation as some element of his repertoire, he gets a new way of seeing it and a new possibility for action in it, but the adequacy and utility of this new view must still be discovered in action. Reflection-in-action necessarily involves experiment.

In the most generic sense, to experiment is to act in order to see what will derive from action. Schön conceives of three forms of experimentation, of which the practitioner partakes: exploratory, move-testing and hypothesis-testing (p. 145):

> When action is undertaken only to see what follows, without predictions or expectations, I shall call it exploratory experiment. This is much of what an infant does when he explores the world around him, what an artist does when he juxtaposes colors to see what effect they make, and what a newcomer does when he explores a strange neighborhood. Exploratory experiment is the probing, playful activity by which we get a feel for things. It succeeds when it leads to the discovery of something there. (italics in the original)

When the practitioner takes action in order to produce an intended change, he performs a move-testing experiment: ". . . a carpenter who wants to make a structure stable tries fastening a board across the angle of a corner; a chess player advances his pawn to protect his queen; a parent gives his child a quarter to keep the child from crying" (p. 146).

> Any deliberate action undertaken with an end in mind is, in this sense, a (move-testing) experiment. In the simplest case, where there are no unintended outcomes and one either gets the intended consequence or does not, I shall say that the move is affirmed when it produces what is intended for it and is negated when it does not. In the more complicated cases, however, moves produce effects beyond those intended. One can get very good things without intending them, and very bad things may accompany the achievement of intended results. (italics in the original, p. 146)

Hypothesis-testing experimentation is like the classical scientific experiment. The practitioner tries to choose among competing hypotheses which address the same problematic situation. In accordance with the philosophy of Karl Popper, Schön has the method of experimental hypothesis testing following a process of elimination (p. 143):

> The experimenter tries to produce conditions that disconfirm each of the competing hypotheses, by showing that the conditions that would follow from each hypothesis are not the observed ones. The hypothesis that most successfully resists refutation is the one that he accepts.

The "on-the-spot experimenting" aspect of reflection-in-action carries the same logic of hypothesis testing, according to Schön, as in the research context. But there are several distinguishing features between the research context, and the practice context of experimenting,

> . . . all of which have to do with the relationship between changing things and understanding them. The practitioner has an interest in transforming the situation from what is to something he likes better. He also has an interest in understanding the situation, but it is in the service of his interest in change. When the practitioner reflects-in-action in a case he perceives as unique, paying attention to phenomena and surfacing his own understanding of them, his experimenting is at once exploratory, move-testing and hypothesis-testing. The three functions are fulfilled by the very same actions. And from this fact follows the distinctive character of experimenting in practice. (p. 147)

To conclude this presentation of the set of constructs in the concept of reflection-in-action, it is worth noting the characteristics that markedly distinguish it from the traditional view of the nature of professional knowledge. It is not unfamiliar to speak of the dichotomies on which Technical Rationality rests: the separation of means from ends, of research from practice, and of knowledge from doing. According to the tenets of reflection-in-action, practice _is_ a kind of research. In their problem setting, practitioners frame the means and ends of their action interdependently, and in their inquiry is a transaction with the situation in which knowing and doing are inseparable.

Summary

Schön's notion of reflection-in-action has been put forth to conceptualize the way teachers reflect on their practice. In addition, it is sufficiently sophisticated to deal with the needed conceptualization of an interface between theory and practice as presented in Chapter One.

This investigator recognizes the value of the notion of reflection-in-action in that it addresses epistemological questions about what beginning teachers "see" in their own practice, particularly what they see as a means of improving practice. Here the practice of teaching is regarded as a practical, disciplined art. Good teaching depends upon insight, and insight comes from reflection. This is much of what Schwab speaks of in his notion of eclecticism, or Roberts, in his idea of informed eclecticism.

In summary, Schön includes five categories in his conceptualization of reflection-in-action. The first two — problem setting and reframing -- focus on the epistemological features of the practitioner's view of his or her practice. What the practitioner "sees" in the events of practice largely determines how he or she will respond in a given situation. Problem setting and reframing capture the acts of "seeing" different "things" in phenomena, in different ways.

The remaining three categories deal with experiment in practice -- acting out a pre-conceived strategy either to obtain an intended consequent or to find out what happens. Exploratory experiment, move-testing experiment and hypothesis-testing experiment correspond to the various means by which practitioners put to use the insights derived from problem setting and reframing.

Next, in Chapter Four, the categories included in Schön's conception of reflection-in-action are applied to data collected about the practical component of the methods course, and the resulting "clue structure," or set of criteria, for detecting reflective activity is put forth.

Chapter 4

ANALYSIS OF THE DATA

The purpose of the first three chapters of this document has been to argue for the significance of Schön's epistemology of practice as a way to understand and research the matter of elementary science teacher education. The task pursued in this chapter is to demonstrate the linkage between this theoretical perspective and actual events in the clinical supervision of methods students. The research problem, as stated in Chapter One, is to determine whether Schön's conceptualization of reflection-in-action is applicable, and appropriate, to studying the clinical supervision of elementary science methods students. This has entailed developing and assessing a "clue structure" (set of criteria) for detecting reflective activity on the part of methods students as they examine their own teaching performances. Before presenting the clue structure and demonstrating its use, it is appropriate to elaborate upon the methodology utilised in the analysis of data.

Methodology

Initially, the data for this study consisted of transcriptions of five lessons that were taught by methods students and the discussion of those lessons that ensued between the investigator (clinical supervisor) and each person who taught. The data were collected in late October and early November of 1984 during the latter part of the methods course, just prior to the methods students' first practicum. While the investigator has drawn contextually on all five lessons and discussions for the study, one lesson/discussion is especially informative and has therefore been chosen for detailed analysis and presentation here. The full transcription of the lesson is presented in Appendix A. The full transcription of the clinical discussion of that lesson, together with analytical comments relating to the supervisory dialogue, is presented in Appendix B. The names of the methods students and all of the pupils who engaged in the lesson dialogue have been changed to maintain their complete anonymity. The reader will be directed to the appendices shortly.

The analysis of the data was modeled after an approach put forward by Roberts and Russell (1975) which draws on "informal philosophical analysis" (Kneller, 1966) to examine practice. Informal philosophical analysis is concerned with systematic conceptualization of terms employed to discuss important events in practice, and it is grounded in a demonstrable linkage between theoretical perspectives and issues of everyday life. Thus, in educational research, informal philosophical analysis is rooted in the events of educational practice itself, and indeed the products of informal analysis may comprise the bases from which implications for educational practice may be derived. The Roberts/Russell approach first draws on a systematic theoretical perspective as the source of an "analytical scheme", or set of categories for the analysis, and then proceeds to develop a "clue structure," that is a set of criteria for identifying instances of events.

Development of the Analytical Scheme

In the present study, the theoretical perspective provided by Schön's conceptualization of reflection-in-action has been applied to the context of science teacher education. Schön developed five categories in his conceptualization: problem setting, reframing, exploratory experiment, move-testing experiment, and hypothesis-testing experiment. Theoretically speaking, the latter three categories -- those involving experiment -- necessarily require opportunities for the practitioner to employ in practice those insights derived from the former two categories. In the context of a study such as this one, this would mean including a second lesson so that methods students could attempt to change in their teaching "salient patterns" that were identified in the first supervisory discussion. Therefore, due to the constraints of this study, the three categories of reflection-in-action that involve experiment have been eliminated.

Hence the analytical scheme was developed theoretically from only two of Schön's categories: those regarding problem setting and reframing. Problem setting, in summary, is the process by which the practitioner identifies the problematic phenomenon of the situation to which he or she will attend, and frames the context in which he or she will attend to it. Reframing is "seeing" in the situation new particulars that give rise to new understandings of the problematic phenomenon, as well as new possibilities for action in the situation.

When shifted from Schön's contexts (architecture, psychiatry and town planning) to the present context of teacher education, the initial theoretically derived analytical scheme required refinement. Two categories, adapted from Fuller and Bown's (1975) developmental conceptualization of teacher concerns, were added to Schön's two categories: (1) the notion that in becoming a teacher, education students learn to interpret classroom events from pupil-centered perspectives, rather than perspectives that are teacher-centered, and (2) the point that education students rely on personal experience as a student to assist them in assembling meaning from these pupil-centered perspectives.

Development of the Clue Structure

Upon inspection of the data, it was clear that "acts of reflection" (consistent with Schön's theoretical formulation) had to be distinguished from "acts of rationalization" on the part of the methods students. The latter consist of moves undertaken to justify, or defend, a particular teaching behavior. Acts of rationalization were common to all five of the methods students, particularly during the initial stages of discussion about their teaching performances. Acts of reflection are very different in nature. They involve moves undertaken to play out the implications derived from various perspectives, or theoretical lenses, employed to make sense of the methods students' teaching experience.

Acts of reflection were seen to occur in three phases, which may collectively be referred to as a "cycle of reflection." As the data were analysed, the cycle of reflection became more and more evident in the supervisory dialogue and, eventually, the conceptualization of the reflective cycle served as the basis from which the clue structure was developed.

The reflective cycle was conceptualized, in the main, to deal with repeating patterns of "negotiation about practice" that can be seen in clinical supervision dialogue. The cycle consists of three phases, which are quite distinct in character, but which lead into one another in a regular fashion. It should be made clear that these phases are analytic devices, and that therefore they do not always occur in groups of three and only once in a cycle. They are qualitatively different components of reflection in clinical supervision discussion.

Phase I - Initial Problem Setting

In phase one of the cycle an "initial problem" is found in the teaching. The problem will usually be shaped and somewhat changed by the end of the cycle, thus the qualifier "initial." The teacher or the supervisor can begin this phase by calling to attention certain aspects of the teaching, or of the classroom events more generally, which are problematic. When the problematic phenomenon is named by the teacher, self-concerns are sometimes exposed in the process. However, this is more evident at the beginning of the supervisory discussion. The framing of the initial problem allows the teacher to formulate a conclusion(1) about the problematic phenomenon, as well as an implication(1) for future practice. This sets the discussion up for the second phase of the reflective cycle. (The significance of the designation "(1)" is to mark the conclusion and implication as initial.)

Phase II - Reframing

In this phase, the problematic phenomenon is re-examined from one, or perhaps several theoretical platforms. Reframing does not usually occur only once, but several times. Often, counter examples are constructed and contrasted to the problematic phenomenon. In addition, there is usually a shift from teacher-centered interpretations of classroom events, to interpretations that are pupil-centered. As the consequences of certain pupil interpretations are played out, the teacher is sometimes requested to reflect on his or her personal experience as a student to help make sense of the pupils' perspectives. Sometimes the supervisor offers anecdotes from his own personal experience to make a point. The result of the reframing process is a deeper understanding of the problematic phenomenon, based on the insights derived from the alternative perspectives and theoretical platforms used to examine them.

Phase III - Resolve

The resolve is the product of all of the work done in phase two. A new conclusion(2) about the problematic phenomenon is formulated, and a new implication(2) is often derived.

The reflective cycle occurs within an "episode" of dialogue, which is that portion of the discussion devoted to a particular topic, such as classroom management, pacing, questioning, or an incident in the lesson.

The Clue Structure

The clue structure for detecting reflective activity in supervisory dialogue has been crafted from the concept of the reflective cycle and refined through repeated application to the data. There are four clues, which are stated here in the form of questions:

Clue 1: Can the phases of the reflective cycle be "seen" in the dialogue? Is there a period of reframing activity?

Clue 2: Is there evidence of a change in the perspective from which a classroom phenomenon is viewed? Specifically, does the teacher make a shift from using teacher-centered to using student-centered interpretations of the classroom event?

Clue 3: Does reframing result in a change in the conclusions about the problematic phenomenon or in the implications that are derived for practice? That is, is there a change in the "I should have's"?

Clue 4: In the course of reframing, does the teacher draw from his or her personal experience as a student to make sense of the pupil's position?

Analysis: Using the Clue Structure

Excerpts of clinical supervision discussion with Wendy -- the methods student who taught the lesson presented here (actually the second lesson in the sequence of five) -- will be presented shortly to show how the clue structure was applied and tested. Wendy received the transcription and audio-recording of her lesson three days prior to the clinical discussion with the investigator. The analysis of that discussion will be more meaningful if the reader now turns to a complete reading of the lesson (Appendix A), before proceeding here.

The following excerpt is the discussion that took place over the introduction of the lesson, which had been labelled in the methods course as "Establishing the Hook." The purpose of this part of the lesson was to review with the pupils the meaning of the term "environmental factor," which was introduced in a previous lesson when they conducted an experiment to find out what type of light conditions isopods prefer. "Establishing the Hook," then, refers to making the link between Wendy's lesson and the previous lesson in this unit of study.

It will be useful to review the introduction of the lesson before dealing with the discussion in Excerpt 1:

3 Teacher: O.K., I see you've already been peeking in there . . . that's part of our project. (refers to the buckets of pond water) That's all right. You've been looking at environmental factors I've been told. Does anyone want to tell me what an environmental factor is? Yes?

4 Student: Air pollution.

5 Teacher: Air pollution, O.K.

6 Student: Water pollution.

7 Teacher: Sorry?

8 Student: Water pollution.

9 Teacher: Water pollution, O.K. I think you were perhaps using isopods. Were you working with isopods? What sort of environmental factors did you find? Yes, Harry?

10 Harry: That they like going to corners and, usually, dim parts of the runway.

11 Teacher: So what's the environmental factor?

12 Harry: That they like going to the dim parts.

13 Teacher: The dim parts. Yes?

14 Student: Isopods prefer finer sand and dimmer parts.

15 Teacher: Uhmm uhmm. Anything else?

16 Students: (silence)

17 Teacher: Would there be any other environmental factors that you can think of? No? Is there anything else here Tom?

18 Tom: Uhmm, well . . . the babies aren't used to the dim light and so they move to the light. And . . . I don't know.

19 Teacher: Anything else? No? O.K., we're going to look at environmental factors in a little bit different way.

The clinical discussion about the introduction of the lesson is presented next in order to display for the reader how the clue structure is used to detect the three phases of the reflective cycle and reflective activity in the supervisory dialogue. The dialogue is broken up into segments to allow for analytical comments to be made in the text. (T = (Teacher) Wendy, C = Clinical Supervisor)

39 C: O.K., well let's begin just where you begin speaking here on page (85), #3. The kids were peeking in the buckets just while Mr. X was introducing you, is that right? Did you want to read out loud, or would you like me to?

40 T: Whatever.

41 C: O.K., "I see you've already been peeking in there . . . that's part of our project. That's all right. You've been looking at environmental factors I've been told. Does anyone want to tell me what an environmental factor is? Yes?" And the student says, "Air pollution." And you say, "Air pollution, O.K." And another student says, "Water pollution." "Sorry?" "Water pollution." "Water pollution, O.K. I think you were perhaps using isopods. Were you working with isopods? What sort of environmental factors did you find? Yes Harry?" "That they like going to corners and dim parts of the runway." So what was the environmental factor?" "That they like to go to the dim parts." "The dim parts. Yes?" Does anything cross your mind yet?

42 T: Do you want me just to cut in on you as you're going along?

43 C: Yes.

Reflective Cycle 1: Phase I -- Initial Problem Setting

44 T: O.K. Well the first thing I notice is that I say "O.K." far too often . . . which I wasn't aware of. But when I started this, I was very unsure how to open the lesson. How to . . . other than just say, "You've been talking about environmental factors," I really didn't feel that I had a good opening line. And I find this all the way through. Like, I wasn't listening all that closely to what the kids were saying. Like, my response to them . . . I was listening to them, but I didn't respond in that manner.

45 C: Why do you say that?

46 T: Well, there's one instance that I noticed later on when I cut in on a student as he was talking. But that was when he had answered with exactly what I was looking for.

47 C: And you got excited.

48 T: Yes. But I found I was repeating the students' answers quite a bit. Now, whether that's wrong or right, I thought I should have tried to get the kids to say a little bit more.

49 C: Why would you want to do that?

50 T: To clarify their meaning to both myself and the rest of the class, and try to see why they were coming up with those answers.

51 C: Now, can you see an example here on the page that would illustrate that?

52 T: Well, O.K., with these first two -- air pollution and water pollution -- I understood where they were coming from, but whether the rest of the class did or not . . . And that wasn't what I was looking for; that's why I brought up isopods.

53 C: Oh I see. So "air pollution" and "water pollution" really didn't . . . really weren't examples of environmental factors?

54 T: They weren't the ones I was looking for. I wanted to get them on to thinking about the light, and what they had been doing with isopods.

55 C: Did air pollution and water pollution, given as examples of an environmental factor, satisfy what you expected them to know about the word, or the term "environmental factor?"

56 T: I didn't expect them to come out with things like that.

57 C: Yes, neither did I.

58 T: I found that several times throughout this . . . that they had a lot more knowledge than what I would have expected them to have at that stage.

59 C: Was that scary for you?

60 T: Yes, definitely.

61 C: I guess on the one hand you want them to tell you what they know, but you want to be able to handle it at the same time.

62 T: That's right.

63 C: And to sort of shape it into the meaning you want. O.K.

64 T: Again, I can see some of this causing me to be uneasy because I didn't know what they'd covered already, or what they'd had previously.

65 C: Sure. Actually, right now in terms of your development, you know very little about kids compared to what you will know about them.

66 T: As far as what they learn in school. Also, down here where the one fellow said that the isopods like to go to the dim parts, I think in that case . . . because that was pretty close to what we were looking for, I should have gotten him to give a little bit more on that.

67 C: How could you have done that?

68 T: Right now I honestly don't know. Perhaps get him to explain it in a different way or . . .

69 C: O.K. . . .

This first portion of the "Establishing the Hook" episode illustrates Phase I of the reflective cycle -- the initial problem setting. First, in utterance 44, Wendy frames the problematic phenomenon:

> Like, I wasn't listening all that closely to what the kids were saying. Like, my response to them . . . I was listening to them, but I didn't respond in that manner.

Second, Wendy's initial view leads her to name an implication(1) for practice in utterance 48, and again in utterance 66:

> . . . I thought I should have tried to get the kids to say a little bit more.

Finally, in utterance 54, Wendy states her conclusion(1) about the problematic phenomenon, namely, that the "hook" was not established in the introduction of the lesson:

> **They (air pollution and water pollution) weren't the ones (examples of environmental factors) I was looking for.**

From here, the discussion leads into Phase II of the reflective cycle -- the reframing activity:

70 T: On page (86) #12.

71 C: Right. I'm just looking up into the discourse that happens just before that point. To just briefly summarize it, you ask for examples of environmental factors, probably to get to their understanding of the term or the concept. And they give you things that you weren't expecting . . . and you go with the flow. "Air pollution, O.K." Someone else says "Water pollution." Do you see what I mean? And then you make an adjustment . . .

72 T: To get them back on track.

73 C: To get them back on track. So, "I think you were perhaps using isopods. Were you working with isopods?" They must have nodded their heads, right? "What sort of environmental factors did you find? Yes, Harry?" So we're back on to environmental factors and isopods, in the context of isopods, and we're looking for light, moisture, temperature and things like that.

74 T: Actually just light. They hadn't done the other two.

75 C: O.K. "They like going to the corners and usually the dim parts of the runway." Well, I suppose what he said isn't really an environmental factor is it?

76 T: No. I was trying to get him to tell me . . . not where they had gone, but . . .

77 C: But to just use the word "light". And so what's wrong with what you did? "So what's the environmental factor?"

78 T: And he just repeated what he had said before, basically. Except he did shorten it. I suppose I was still concerned at that time . . . I was still very nervous at that time and I was trying to get him to say, "light" and nothing else, sort of thing.

79 C: Well, you see it's not as bad as you think . . . I don't think. He's talking about their activity and you want him to say, "light." "So what was the environmental factor?" You're focusing him in and then he repeats the same thing.

In the passage above, the supervisor has introduced Wendy to a different way of viewing the problematic phenomenon. Although he doesn't explicate the difference, he judges the teaching performance in the introduction of the lesson favorably. This he does by focusing, in utterance 77, on Wendy's question, "So what's the environmental factor?" He bases his judgement on the intention of the question, namely to have the student identify the environmental factor as "light."

The reframing activity continues later on in this episode, but in the next short passage, Wendy moves directly into Phase III of the cycle — the resolve:

80 T: Well, actually, when he answers he does say that they like to go to the dim parts, so . . . seeing it now like . . . he has picked out what I was looking for.

81 C: O.K. (pause) And things continue to flow along quite nicely. You're shaping the ideas, I think, quite nicely. Teacher: "The dim parts. Yes?" And then, "Isopods prefer finer sand and dimmer parts." And then the "Anything else?", and silence after that. How do you read that?

82 T: (pause) I don't remember from the actual time. Uh, . . .

83 C: It was sort of like . . . that was it. They'd given you everything that they had. "Would there be other environmental factors that you could think of?" Tom says, "Well the babies aren't used to the dim light and so they move to the light. And I don't know . . ."

84 T: I actually think I should have left it the way it was instead of, you know, kept pushing for something else . . . for them to say, "light" and nothing else. And I think that's . . . from my understanding in looking at in now . . . that's what I was doing. I didn't accept what they said about going to the dim parts. I wanted them to explicitly say "light" and nothing else.

In this portion of the discussion, Wendy has formulated a new conclusion(2) about the problematic phenomenon in utterance 80, as well as a new implication(2) for practice in utterance 84. This does not necessarily mean that she has used the supervisor's frame (utterance 77) to do so, but rather that the supervisor's reframing has triggered Wendy's own reframing of the problematic phenomenon.

Thus far, the analysis of the supervisory dialogue has illustrated the use of Clue 1 and Clue 3 of the Clue Structure: That is, the three phases of the reflective cycle are evident in the dialogue (Clue 1), and there is a change in Wendy's "I should have's" (Clue 3). The remaining two clues will be illustrated in the final portion of discussion in this episode, which begins with the supervisor resuming the reframing activity:

85 C: Well do you think that you pushed them too hard?

86 T: Actually I don't think so, no. Because they didn't . . . they didn't react badly to it or anything. They were still all with me and everything at the time, so . . .

87 C: Do you think that it's important to push them a little bit?

88 T: In some cases, yes.

89 C: Well, you want to deliver sort of a challenge, don't you? Give them something to do and have a worthwhile purpose for them doing it? I don't know if they'd like it very much if you gave them all the answers.

90 T: No, no. Certainly not. I can see that.

91 C: In fact, that might really backfire, you know. If you were to give them all the answers.

92 T: It would be boring for them.

93 C: Let them off the hook a little too easily. What do you think would happen?

94 T: I think they'd get distracted very easily. They wouldn't, on their own . . . they wouldn't develop because children usually have that curiosity for starters . . . it's teachers who end up stifling it in them. That's my personal opinion, however.

95 C: What makes you say that?

96 T: Why do I say that?

97 C: Your own experience?

98 T: My own experience, yes.

99 C: What happened?

100 T: Nothing in particular that I can remember, but I know that I was very enthusiastic when I started school, and I was until about junior high.

101 C: Uhmm uhmm.

102 T: And then I had a lot of old teachers who really didn't care what you were doing . . . and . . . I used to get away with a few tricks . . . you know, you'd hand in an assignment with the middle part missing out of it and they'd never notice.

103 C: Oh heck. Gee whiz.

104 T: And I found that they weren't interested in what you were doing. They had their list of what to get through and that was it. And they really didn't care how they did it. That sort of really turned me off for a while.

105 C: They didn't challenge you.

106 T: No, not at all.

In this passage, the supervisor began the reframing activity with Wendy's implication(2), which she stated in utterance 84. There she said that she should not have "pushed" the students to say "light" and nothing else. The supervisor's frame had to do with challenging students, and he equated this with the "pushing" metaphor. Wendy reflected on her own personal experience as a student in order to make the case that when teachers do not challenge, they end up stifling childrens' curiosity. The passage thus illustrates the use of Clue 4 (reflecting on personal experience as a student).

107 C: O.K., well I like what you're doing here . . . pushing them a bit. And to be honest with you, that . . . you know that your questioning technique is quite clear . . . I think the questions are clearly delivered. And when something isn't quite right, and you want to communicate that you're pushing . . . that comes across quite clearly to kids. I think due to the evidence we have here. They are actually satisfying your push. Do you know what I mean?"

108 T: Uhmm uhmm.

109 C: A lot of times beginning teachers have problems with questions. They find that their questions aren't explicit enough . . . that the meaning of the question is slightly ambiguous, and the kids struggle to find out what it is that the teacher wants. And so quite often you'll find that a beginning teacher will ask a question and then there's silence. Nobody knows what he wants. So he repeats it in a different way . . . see? Well, that's not really happening as far as I can see anyway in this first part.

110 T: Is that a bad thing to do though?

111 C: To rephrase? Well it's not a bad thing to do . . . I think it's a good thing to realize that the question has been ambiguous . . . in which case it's an excellent thing to do . . . rephrase the question. But I think it's better if you can anticipate . . .

112 T: And avoid that for starters.

113 C: And avoid that, yes. But I don't see a problem with your questioning here. Perhaps you'll want to keep that in mind and raise something later on if you want.

114 T: O.K.

115 C: Let's just continue then. "Anything else? No? O.K., we're going to look at environmental factors in a little bit different way." Now the lesson sort of shifts here doesn't it.

116 T: Uhmm uhmm. That was the beginning of my introduction . . . what I was going to be going into.

117 C: So, in the terms we've used in class, you've done your "hook" -- you've hooked up to what the kids have done previously in class. So you have them set for the lesson, right? Now, you were wondering a minute ago about your opening statement . . . "You've been looking at environmental factors, I've been told." Well, this whole little episode has occurred in twenty or thirty seconds . . . somewhere in there. And I think it's a nice little link . . . they're hooked right into the frame of mind that they left their last class with. And now you're ready to begin. I guess what I mean to say is that perhaps it would be more useful to think of the entire piece of talk and how it functions, rather than just your opening comment. O.K.?

118 T: The whole introduction then.

119 C: Right, the train of thought. But let me just get this straight. When you began the introduction to this lesson, were you satisfied that the kids knew what an environmental factor is?

120 T: Yes.

From here the discussion moves on to another topic, thus both the "Establishing the Hook" episode and the reflective cycle that occurred within it are drawn to a close. The use of Clue 2 can now be illustrated by reviewing some of Wendy's utterances that occurred along the way.

Clue 2 is concerned with whether there is evidence in the discussion that the teacher shifts from using teacher-centered to using student-centered interpretations of classroom events. In this cycle of reflection Wendy does make such a shift in regard to her views about students "getting the point."

First, from the teacher-centered interpretation, Wendy's conclusion is that the students did not get the point. Notice, again, utterance 66 from Phase I of the cycle:

> . . . Also, down here where the one fellow said that the isopods like to go to the dim parts, I think in that case . . . because that was pretty close to what we were looking for, I should have gotten him to say a little bit more on that.

Later, in Phase III of the cycle, Wendy achieves a new interpretation (utterances 80 and 84):

> Well, actually, when he answers he does say that they like going to the dim parts, so . . . seeing it now . . . he has picked out what I was looking for.
>
> I actually think I should have left it the way it was instead of, you know, kept pushing for something else . . . for them to say, "light" and nothing else. And I think that's . . . from my understanding of it now . . . that's what I was doing. I didn't accept what they said about going to the dim parts. I wanted them to explicitly say "light" and nothing else.

Finally, at the end of the episode (utterance 120) when the supervisor asks Wendy if she was satisfied that the students knew what an environmental factor is, she says, "Yes." These data suggest that Wendy has achieved her new view by shifting to the pupils' perspective in her interpretation of classroom events.

More on the Clue Structure

The detailed analysis and discussion in this chapter presents the clue structure and its use in context in a particularly revealing portion of supervisory dialogue. To complete the picture, the remainder of the discussion of the lesson appears in a more economic format in Appendix B. There, the clue structure is put to further use in detecting a total of eight reflective cycles that occurred in the discussion.

The material in Appendix B is presented in two columns. The left-hand column contains the entire discussion of the lesson. Analytical comments matching the clue structure to specific areas in the discussion are entered in the right-hand column. Furthermore, the discussion is broken up into ten episodes, which are equivalent to the major topics that were covered. These are numbered and appropriately titled in the right-hand column as well. Finally, the reflective cycles that occur within the episodes of discussion are also numbered. A convenient way to go through the material in Appendix B is to read the discussion in each episode first, then re-read that discussion along with the analytical comments before moving on to the next episode. The meaningfulness of the conclusions and implications of the study will be enhanced if the reader "digests" all of the material in Appendix B at this point, before reading further.

Summary

This chapter began with the research problem of the present study -- to determine whether Schön's conceptualization of reflection-in-action is applicable, and appropriate, to studying the clinical supervision of elementary science methods students. Following that, the methodology utilized in the study was presented. First, the theoretical derivation of the analytical scheme used for focusing reflection-in-action on the content of science teacher education was shown. This entailed two moves: eliminating those categories of reflection-in-action that involve experiment (exploratory experiment, move-testing experiment and hypothesis-testing experiment), and blending with the two remaining categories of reflection-in-action (problem setting and reframing) two further categories adapted from Fuller and Bown's work (teacher-centered/pupil-centered interpretations of classroom events, and utilising personal experience as a student to help construct meaning from the pupil-centered interpretations).

Discussion in this chapter then moved on to show how, when the analytical scheme was applied to clinical supervision dialogue, the concept of the reflective cycle and its associated clue structure were developed. In summary, the cycle of reflection consists of three phases: initial problem setting, reframing and resolve. In phase I, the problematic phenomenon is called to attention and initial conclusions and implications are derived about it. In Phase II, reframing, the problematic phenomenon is re-examined from one or several theoretical platforms. This process then gives rise to new conclusions and implications about the problematic phenomenon, which are formulated in Phase III, the resolve.

The clue structure, or set of criteria, for detecting the reflective cycle and reflective activity in supervisory discussion consists of the following four questions:

> Clue 1: Can the phases of the reflective cycle be "seen" in the dialogue? Is there a period of reframing?
>
> Clue 2: Is there evidence of a change in the perspective from which the classroom phenomenon is viewed? Specifically, does the teacher make a shift from using teacher-centered to using student-centered interpretations of the classroom event?
>
> Clue 3: Does reframing result in a change in the conclusions about the problematic phenomenon or in the implications that are derived for practice? That is, is there a change in the "I should have's"?
>
> Clue 4: In the course of reframing does the teacher draw from his or her personal experience as a student to make sense of the pupil's position?

The reader was then shown how the clue structure was used to detect eight reflective cycles and the reflective activity in the clinical supervision dialogue with Wendy. This involved presenting the detailed analysis of excerpts of dialogue from the "Establishing the Hook" episode of discussion, as well as showing the analysis of the entire supervisory discussion in Appendix B. Next in chapter Five, the conclusions and implications of the study are put forth.

Chapter 5

CONCLUSIONS, LIMITATIONS AND IMPLICATIONS

Chapter Five begins with a review of the argument that has been crafted in this study. Then, the analysis is reviewed and the conclusions and limitations of the study are put forth. Following that, two theoretical matters that are integral to this work are given further attention.

The first deals with the assertion made in Chapter One that the theoretical perspectives presented in the methods course come to life in the practical teaching experiences offered therein. Theoretical notions have indeed been used here in clinical supervision for the reflective and diagnostic analysis of actual teaching. Hence the use of methods course substance in the clinical discussion of Wendy's lesson is reviewed.

The second matter has to do with using the concept of the cycle of reflection as a microstructure to guide the conduct of clinical supervision. Finally, implications for further research and implications for practice that are raised by the study are discussed.

Review of the Argument

The study began with a look into some of the problems that education students confront in the process of becoming teachers: preservice teacher education courses in methods have been accused of being too theoretical, and education students have typically had neither the experience in the teaching role nor the concern about pupils required to make sense of theoretical notions about teaching. This investigator (among others) suggested that by including practical teaching experiences in methods courses, and by using theoretical notions to make sense of those experiences, teacher educators can overcome, or at least lessen the problem.

The investigator reviewed pertinent position statements and empirical studies purporting to deal with the matter of blending theoretical and practical material in preservice methods courses. The position statements are clear and increasingly specific, in recent years, about the importance of making the blend operational. But the empirical studies show conflicting and unhelpful results, judged by the investigator to be partly due to inadequate practical conceptualization of what is required to orchestrate a meaningful blend, and partly due to the view of knowledge behind prevailing approaches to research on a problem of this sort.

The techniques of clinical supervision were put forward as a vehicle capable of merging the theoretical content and the practical component of the methods course. This involved establishing a conceptualization of the interface between theory and practice that is rich enough to deal with the logical, epistemological and ethical elements of informed decision making in teaching.

Furthermore, various views about the character of knowledge in the field of education have been explored. These range from a view of educational knowledge as a body of science-like theory, to a view of educational knowledge as artistic in quality, to a conception of knowledge about teaching that is "practical" in nature. The investigator has taken the position that (1) teaching is a disciplined practical art, (2) good teaching depends upon insight, (3) insight comes from reflection, and (4) occasions that enable us to achieve new understandings of our practice, giving rise to new directives for practice, are fundamental to learning about the art of teaching. The main body of the study has dealt with applying Donald

Schön's conceptualization of reflection-in-action to the context of teacher education. This conceptualization has been engaged to conceive of the nature by which beginning teachers, in the clinical supervision setting, come to new understandings of their practice, as well as new implications for future practice.

The study drew on informal philosophical analysis, as proposed by Roberts and Russell (1975), as the methodology for examining practice. First, Schön's conceptualization of reflection-in-action was translated to the context of teacher education by developing an analytical scheme that does two things, essentially. It focuses on two of Schön's categories, namely, problem setting and reframing, by eliminating the other three categories, which deal with experiment in practice. It also takes into consideration two theoretical dimensions that are adapted from Fuller and Bown's (1975) developmental conceptualization of teacher concerns. The first of these is the notion that beginning teachers learn to interpret classroom events from "pupil-centered" perspectives, rather than "teacher-centered" perspectives. The second is the idea that beginning teachers draw upon their personal experience as a student in formulating pupil-centered perspectives, and in making sense of the pupil's position.

Analysis of the data was then presented, and the reader was shown how the concept of the cycle of reflection led to the development of the clue structure. This is a set of criteria for detecting the phases of the cycle of reflection and reflective activity in clinical supervision dialogue. The cycle consists of three phases -- initial problem setting, reframing and resolve -- which are reviewed in more detail below. Finally, the reader was shown how the clue structure was put to use to identify a total of eight reflective cycles that were seen to occur in the clinical discussion with

Wendy. The clue structure consists of the following four questions:

> Clue 1: Can the phases of the reflective cycle be "seen" in the dialogue? Is there a period of reframing activity?
>
> Clue 2: Is there evidence of a change in perspective from which a classroom phenomenon is viewed? Specifically, does the teacher make a shift from using teacher-centered to using student-centered interpretations of the classroom event?
>
> Clue 3: Does reframing result in a change in the conclusions about the problematic phenomenon or in the implications that are derived for practice? That is, is there a change in the "I should have's"?
>
> Clue 4: In the course of reframing, does the teacher draw from his or her personal experience as a student to make sense of the pupil's position?

Next, the reflective cycle and the use of the clue structure for detecting reflective activity in clinical supervision dialogue are reviewed, and the conclusions and limitations of the study are put forth.

Conclusions and Limitations

The analysis presented in Chapter Four has led to several conclusions. Generally, Schön's ideas regarding reflection-in-action provide a useful way to interpret how preservice teachers make sense of their early teaching performances. One of the underlying themes of the study is that reflection should not be confused with rationalization. Problem setting and reframing are the categories that alert us to what reflection looks like. Furthermore, the concept of the reflective cycle, which focuses Schön's ideas on the context of teacher education, together with the clue structure presented in this study, alert us to what it looks like when a beginning teacher reflects on her own teaching. The analysis of the data shows that problem setting and reframing (phase I and phase II of the cycle of reflection) can be seen to occur in the discussion with Wendy. The conclusions are (1) that the clues are faithful to Schön's work, (2) that they do, indeed, detect reflection in clinical supervision dialogue, and (3) that the concept of the reflective cycle and its associated clue structure are applicable and appropriate to studying clinical supervision dialogue; the reflective cycle provides a means of "chunking" dialogue into units, which are then ready to be examined.

Not only has the analysis of data shown that reflection can be detected in clinical supervision dialogue, it also has shown that a preservice teacher can indeed reflect. A fourth conclusion, then, is that preservice teachers can reflect, given the proper situation (in particular, the occasion to teach, the transcript and the supervisor).

The cycle of reflection, in summary, involves three phases: initial problem setting, reframing and resolve (for more detail, review pp. 48-50). Clue 1 asks whether these phases can be seen in the dialogue. It therefore corresponds directly to Schön's categories of problem setting and reframing. For example, one knows that the teacher has set a problem when initial conclusions about a particular phenomenon are stated, and when initial implications for future practice are derived from those conclusions. Once that phase has been identified, one can then know that reframing occurs when the problematic phenomenon is viewed in another way -- say, from a new theoretical perspective or, to use Schön's term, from a different fundamental principle. The resolve is the product of reframing; it contains a new conclusion about the problematic phenomenon and, usually, a new implication for practice. Clue 3 asks whether there is, in fact, a change in the teacher's conclusions and implications. This, by definition, indicates reflective activity.

In the course of moving Schön's ideas to the context of teacher education, two additional dimensions were added to the clue structure. Although they have been useful additions for the analysis of these data, these dimensions may be particular to the way in which this investigator conducts his own supervisory "sittings." Clue 2 asks whether the teacher shifts from using teacher-centered interpretations of classroom events to using interpretations that are pupil-centered. Clue 4 asks whether the teacher relies on personal experience as a student to make sense of the pupil's perspective of classroom events. The likelihood that Clue 2 and Clue 4 may indeed be useful only to this investigator is recognized as an important limitation of the study. Nevertheless, Clue 2 and Clue 4 are consistent with the investigator's knowledge of what it is to become a teacher, and he does claim that they are faithful to Fuller and Bown's developmental conceptualization of teacher concerns.

The study has also been limited by the fact that only two of Schön's five categories have been used to develop the analytical scheme. Although the constraints of the study made it impossible to look at exploratory, move-testing and hypothesis-testing experimentation in practice, the investigator does believe that he has at least partly uncovered the essence of "experimental design" in practice. What goes on in the clinical discussion with Wendy seems to be equivalent to the design of an experiment: she did leave the clinical discussion of her lesson with several strategies to "try out" in the next opportunity to teach. It would be fascinating to include a second cycle of clinical supervision in future studies, so that the "experiment" aspect of reflection-in-action might be examined.

A fundamental limitation to the study is that it has been a self-report. The investigator's intentions have been woven into the work, and it is plausible that he has "set himself up" for his findings. In addition to this, the investigator acknowledges the limitations inherent in the methodological approach of drawing on informal philosophical analysis to examine practice, although he maintains that such limitations exist in any scholarly inquiry.

Theory and Practice in the Methods Course

There are numerous occasions, in the supervisor's discussion with Wendy, when the "content" of the methods course came to life: the matter of establishing the "hook" in the lesson, the logical dissection of the information presented to children, the notion that children's ideas should count, analysing student feedback, the technique of pattern analysis, the idea of wait-time, and so on. (For example, see the discussion about process skills on page 143.) All of these matters are part of the theoretical material of the methods course. They take on new meanings when methods students discover their instrumental utility in understanding actual classroom events.

Take for example the idea that children "count." The investigator argues that this idea belongs, in Schwab's terms, in the theoretic -- the domain of human affairs that deals with generality. True, the idea is an ethical statement, and it therefore regards a world that is not co-terminus with the world of science. It is, nevertheless, a theoretical notion; it is a moral principle that applies to every case in the practice of education. The notion gains its life, though, when it is applied to a particular event in the world of education, such as when a student is interrupted by his teacher while he is answering her question. This is the link that strengthens teacher education -- that is, the link between the theoretic and the particular world of methods students.

It will be useful to review the discussion in Episode 2 of the lesson once again, this time by noting the content of the dialogue that came from the methods course. To begin, in utterances 48 and 50, Wendy said that she should have had the students say a little bit more in order to clarify their meaning both for herself and for the rest of the students. This represents one of the "principles" dealt with in the methods course. There, we discussed how, when more about what pupils know needs to be determined, the teacher should try to get them to talk a little bit more. But in the course of reframing, a second principle from the methods course was invoked: While teaching science to children, one must listen closely to what they say and try to see what sense they could possibly make out of the lesson, given the nature of the child's world of explanation. The movement from the one principle to the other set Wendy up to re-interpret the problematic phenomenon. She said, in utterance 84, that upon re-examining the discourse she saw that the students did get what she was looking for, but she hadn't acknowledged that they did. She claimed that she had "pushed" the students by trying to get them to say, "light," and nothing else. The discussion then went on to invoke a third principle from the methods course: By challenging students, one can get the most out of their natural curiosity. A fourth principle was invoked when the supervisor spoke about the level of ambiguity for students in the teacher's questions: Because words and phrases can be taken in so many different ways by students, care should be taken when the teacher formulates a question.

The four principles that are pointed out above are examples of methods course substance put to use in the analysis of actual teaching. Notice their character: they are all abstracted from the particular. They have been used, nevertheless, to illuminate particular events in Wendy's teaching.

Much more needs to be said about what have been called "principles" here. No doubt, the questions that can be raised in regard to these will fuel much future thinking. For example, are such things what Elbaz would consider "practical principles?" Are they what Schön regards as "fundamental principles?" For Eisner, would they represent theory in diagnostic use? If so, would these principles be at the hand of the "educational connoisseur?" For these questions the investigator does not, in this study, come to any conclusive answers. However, he does believe that it is possible to isolate and study, in clinical supervision dialogue, those things that do constitute "teaching methodology," and that it is possible to do so in the context of the practical teaching experiences methods students are afforded.

The Microstructure of Clinical Supervision

The techniques of clinical supervision have been used to merge theory and practice in the methods course, and to enable the investigator to study the process of reflection in supervisory discussion. Schön's categories of reflection-in-action have been very useful in the analysis. When taken to the context of teacher education by way of the "reflective cycle" and the clue structure, they can match and account for the events of clinical supervision. And, it has been argued that the clues are indeed accurate in detecting reflection in clinical supervision dialogue.

However, upon retrospection, another outcome of the study comes to mind, namely that reflection-in-action can give a new microstructure to clinical supervision. The microstructure is in the conceptualization of the cycle of reflection. In short, the data contained herein provide an example of what it looks like when a beginning teacher is led to reflection. This might therefore be an addition to the techniques of clinical supervision.

Implications for Further Research

Some research questions arising from the study have already been foreshadowed. The most significant ones, in the investigator's judgement, are the following: Does reflection assume the same shape in the clinical discussion conducted by other supervisors? What does it look like in areas other than science education, such as mathematics and social studies education? Will Schön's category of move-testing experimentation show itself when two sequential cycles of clinical supervision are conducted with a methods student? Does reflection assume the same shape with experienced classroom teachers?

Schön's conceptualization of reflection-in-action has served to illuminate the epistemological features of a beginning teacher confronting his or her own practice. This, in the investigator's judgement, provides a rich conceptual basis from which further research might be conducted. The present study contributes to this line of inquiry into teacher education by proposing an analytical scheme for detecting reflection-in-action among preservice teachers.

Implications for Practice

This study has led the investigator to envisage a teacher education program that would be designed to provoke and to study reflection in preservice teachers. For example, if the practicum of the elementary generalist program occurred in two sequential years (say the third and the fourth), there might be time available for the clinical supervision of students engaged in various teaching exercises. Indeed, the impact of reflection in the first round of the practicum could be sought in the second round.

An important limitation to such a program is the required resources, namely the human resource required for supervision and transcription, as well as the time required for transcription. The investigator has found that the resource problem of transcribing can be overcome when methods students are given their tapes two or three days prior to the clinical discussion with their supervisor. Listening to the tape several times can fuel the reflective process as well as the use of transcripts. The advantage of having transcriptions is that, eventually, a library of teaching transcriptions could be established. Such a library could be used in several ways in university teaching and research.

Another implication for practice has struck the investigator. Upon reflecting on his own supervisory discussions with preservice teachers, he also has achieved new insights and implications for his own practice. He does, for example, recognize that the process of reflection seems to tire after about one hour of discussion in one sitting: the initial episodes of discussion with Wendy are much richer than those toward the end. Surely, other clinical supervisors involved in a such a program would also come across new insights and implications about their own practice.

Concluding Comments

Reflection in teaching begins with a particular teaching event, or a particular construal of teaching events. It does not begin with theory. True, theory is used in the process of reflection, but it is neither the starting point nor the product of reflection. Rather, the starting point of reflection is a particular case in practice, and the products of reflection are (1) understanding each case in a new way, and (2) seeing new possibilities for acting in practical situations. Of course, the conceptual devices, or the "principles," that are used to achieve these understandings might be used in the same manner from one instance of practice to the next. Indeed teachers do rely upon their "repertoires" for making sense of classroom events. But in the end, the path to understanding theoretical notions about teaching, such as those that are presented in methods courses, begins with the examination of practice itself.

The conceptualization of the reflective cycle, together with the clue structure for detecting reflection in clinical supervision dialogue, is put forward here as a way to provoke and to study reflection-in-action on the part of methods students engaged in the clinical analysis of their own teaching.

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Appendix A

Lesson #2 Environmental Factors

84-10-22, 11:00 a.m. - 12:00 a.m.

Teacher: Female student enrolled in an Elementary Science Methods Course. 30 Grade 5/6 Students.

Students enter the room and take their places at their tables. There are six tables in the room. Between the tables and the blackboard, there is a large carpeted area where the students are gathered for discussions. During laboratory activities, students work at their tables. The lesson begins:

1 Teacher: Hello. Could I have your attention please? Could I have tables two, four and six come up and sit on the floor here? And the rest of you, could you turn your chairs around please?

2 Regular Teacher: Boys and Girls, thank you for coming in in a nice organized way. We have a nice long lesson for you today so you really did a good job of getting here fast from recess. I'd like to introduce you to Mrs. X. She's from the university and she'll be teaching you a special science lesson today . . . and it's just great. You'll have a really good time doing it. Mrs. X also has some people with her who will give her some help. So they'll be walking around and talking to you . . . helping you out where you need help as we go through the lesson for today. Just one announcement: Remember that those who are signed up for rocketry, it starts soon. If you haven't brought back your note yet, would you please do so as soon as you can. Put them in the box in the classroom. Thank you. (leaves the room)

3 Teacher: O.K., I see you've already been peeking in there . . . that's part of our project. (refers to the buckets of pond water) That's all right. You've been looking at environmental factors I've been told. Does anyone want to tell me what an environmental factor is? Yes?

4 Student: Air pollution.

5 Teacher: Air pollution, O.K.

6 Student: Water pollution.

7 Teacher: Sorry?

8 Student: Water pollution.

9 Teacher: Water pollution, O.K. I think you were perhaps using isopods. Were you working with isopods? What sort of environmental factors did you find? Yes, Harry?

10 Harry: That they like going to corners and, usually, dim parts of the runway.

11 Teacher: So what's the environmental factor?

12 Harry: That they like going to the dim parts.

13 Teacher: The dim parts. Yes?

14 Student: Isopods prefer finer sand and dimmer parts.

15 Teacher: Uhmm uhmm. Anything else?

16 Students: (silence)

17 Teacher: Would there be any other environmental factors that you can think of? No? Is there anything else here Tom?

18 Tom: Uhmm, well . . . the babies aren't used to the dim light and so they move to the light. And . . . I don't know.

19 Teacher: Anything else? No? O.K., we're going to look at environmental factors in a little bit different way. You looked at light with the isopods and that was an environmental factor. O.K., we're going to look at a slightly different twist to environmental factors. We're going to look at protective coloring O.K.? And I'm going to begin by telling you just a bit of a story . . . and maybe these pictures . . . will give you a little bit of a hint of what we're going to be looking at. (puts up pictures of smoke stacks bellowing black clouds into the air) This basically shows the Industrial Revolution. Does anyone happen to know what that is?

20 Students: (silence)

21 Teacher: Now, it happened quite a while ago . . . and it was over in England . . . and, as you can see, there's factories. What else do you notice about this picture? Yes?

22 Student: Well, there's lots of pollution . . . but the, uhmm . . . I don't know what you call it, but . . . anyways . . . there wasn't any pollution laws.

23 Teacher: Good. Good. O.K., yes?

24 Student: There was lots of smog.

25 Teacher: Yes, there was indeed. Tom?

26 Tom: (student coughs and the response is inaudible)

27 Teacher: I'm sorry, I couldn't hear that.

28 Tom: The smoke goes into the sky.

29 Teacher: Yes it does, uhmm uhmm. And Nancy?

30 Nancy: Sometimes they might put the chimneys really high so the smoke goes way up.

31 Teacher: Yes, right. Anything else that you notice about these pictures? I suppose I'm standing in front of it. (moves to the side) Yes Margaret?

32 Margaret: The factories all have tall smoke stacks.

33 Teacher: Yes they do. And as several of you mentioned, there's quite a bit of smog and pollution there. O.K., I want to tell you a bit of a story. This is a birch tree. (holds up a piece of bark) It sort of looks like birch tree . . . it is bark from a tree, and as you notice it's white. (holds up a white moth) This is a moth which they had . . . this species was found in England at that time. Now, this moth . . . this is one of its favorite resting spots. (holds the moth up to the bark) He likes to sit on this. What do you notice? Jane, yes?

34 Jane: It blends in with the bark.

35 Teacher: Right. They blend in . . . so what good would this do for him? How would this help him? Yes?

36 Student: It would give him camouflage so that his predators couldn't . . .

37 Teacher: Exactly! Very good. Did everyone hear that?

38 Students: Uhmm uhmm.

39 Teacher: O.K., it would protect it from its predators, therefore he would have a better chance of survival. O.K.? Well, what happened, as you noticed . . . there was so much pollution there . . . (holds up a piece of soot covered bark) what happened to the trees? Dan?

40 Dan: They turned all darker.

41 Teacher: That's right. All covered in soot and they're quite a bit darker. (holds the white moth up against the dark bark) Now, this poor moth . . .

42 Dick: No camouflage.

43 Teacher: Right. What was that again Dick?

44 Dick: He can't camouflage himself any more.

45 Teacher: That's right. He sticks out like a sore thumb, right? All this . . . all the birds or any other predators who want to eat him can spot him from quite a ways away, right? There would be no problem. So what do you think happened to the moth? I'm sorry, is it Joe?

46 Joel: Joel.

47 Teacher: Joel?

48 Joel: He'd probably die.

49 Teacher: He'd die. O.K., what else could happen? Yes?

50 Student: He could change colors?

51 Teacher: Right, and what color would he go to?

52 Student: The color of the bark.

53 Teacher: Right, the color of the bark . . . exactly. (puts a black moth up against the soot covered bark) This is exactly what happened to the species of moth. It didn't happen overnight, though. It did take a long time. And this protective coloring . . . which would camouflage him. O.K.? Can you think of any other examples of camouflage or protective coloring?

54 Student: I think some kinds of bugs . . . some kinds of bugs blend in with the things around them . . . the environment around them.

55 Teacher: Yes, can you think of any types of bugs? Not off hand? Joel?

56 Joel: Stick bugs.

57 Teacher: Stick bugs, yes. Very good. And what's the stick bug blend in with?

58 Joel: Well, the twigs.

59 Teacher: The twigs, yes. Greg?

60 Greg: Praying mantis.

61 Teacher: Uhmm uhmm, good. Very good. Yes?

62 Student: Caterpillars?

63 Teacher: Caterpillars? And what . . . how do they blend in?

64 Student: They sit on the leaves and they turn green.

65 Teacher: O.K., Tom?

66 Tom: Fish . . . their bottom side is usually lighter and their top side is usually darker.

67 Teacher: Very good. O.K., that's a good point. We're sort of going to be looking at that today. We're going to be making a pond . . . and Tom sort of knows one of the things that we're going to be looking at. O.K., has anyone made a pond before? You have? O.K., we're going to need a little help here . . . and we're going to try to get everyone involved if possible. I think, though, seeing the size of the group, perhaps everyone sitting down, for starters, can help me spread out this large sheet.

Two large plastic sheets are spread on the carpet. The second one is a circular sheet which is rolled up at the edges to form the banks of the pond. Two pails of pond water stocked with bugs and fish are added. The students sit around the pond watching the bugs as the teacher continues.

68 Teacher: Everyone looking at me please? All eyes. Everyone looking this way? Good. This is pond life we're looking at. And we have to be careful. These are live organisms, O.K.?

69 Dick: Yeah, they can die.

70 Teacher: That's right. Could you repeat that so everyone can hear Dick?

71 Dick: They can die.

72 Teacher: That's right. So we have to handle them very carefully. Jane? You can put down the side of the pond . . . that's right.

73 Student: Look at that leech. Uch.

74 Teacher: Let's just take a look.

75 Student: There's a fish and he's camouflaged at the bottom.

76 Teacher: So we have to be careful not to disturb them by making waves, O.K.? What we're going to do today is we're going to work in partners . . . excuse me Dawn . . . O.K., we're going to work in partners . . . and what we're going to do is . . .

77 Students: (whispering)

78 Teacher: (pause) O.K., we're going to work in partners and I'd like each of you to . . . with your partner, get a specimen . . . when I tell you to go . . . and you're going to take it back to your table to make some observations, all right? We'll give you a worksheet that we'd like you to work on as well. And then if you have time . . . Dawn . . . if you have time, then you can go on and do another sheet. Take a look at a different organism. Let's just spend a couple of minutes now. How many different organisms can you see in here?

79 Students: Lots. Lots.

80 Student: Look at the leech.

81 Teacher: Yes, there's a leech in there.

82 Student: Is that a turtle?

83 Student: The green one right there.

84 Student: There's about twenty-five of them.

85 Student: Is that a leech?

86 Student: That's a leech.

87 Student: The snails have a housing problem.

88 Student: Stretch out leech.

89 Student: There's a minnow.

90 Student: What's that red thing in there?

91 Student: That's a leech.

92 Student: The snails have a housing problem. The snails have a housing problem.

93 Teacher: Has everyone had an opportunity to just look? O.K.? Can I have everyone from table two get a partner and get your organism? (students chattering)

94 Student: How do you get them?

95 Teacher: Sorry. (students still chattering) Over there there are some strainers and little containers. You can pick them up and . . .

Three students go over to the back table to pick up their equipment for catching a specimen from the pond. The rest of the children remain at the pond discussing what they can see. They have not heard the last instructions. Within a minute, though, everyone seems to know how to catch their specimens and soon all of the students are working at their tables. The activity proceeds for about twenty minutes. After the pond has been put away and the students have taken their seats at the tables, . . .

96 Teacher: Excuse me? Excuse me? Could I have tables two, four and six back up on the floor here? Please come slowly and be careful where you sit . . . we've got a few wet spots on the floor. (students from the back tables move up) O.K., perhaps we can just discuss together some of the things that we saw today in the pond . . . and some . . . by taking a closer look at our organism. Can anybody tell me what they saw? What type of organism they had? O.K., yes?

97 Student: A leech.

98 Teacher: A leech? What can you tell us about the leech?

99 Student: Well, it stretches out so it can move. It stretches and then it pulls itself together and . . . that's how it moves.

100 Teacher: O.K., what else did you notice?

101 Student: Well, it's sort of brownish-green so it would blend in with the muddy water.

102 Teacher: Very good. And why would this be helpful? Any thoughts on that?

103 Student: To help hide it from its predators.

104 Teacher: Exactly. Fred, go ahead?

105 Fred: The same thing.

106 Teacher: O.K., Yes Tom?

107 Tom: Dick and I had snails and . . . we found that the snail . . . when ever it was touched, rolled up in its shell. And it moved around by sticking itself and sliding itself around the bottom.

108 Teacher: Did everyone hear that?

109 Students: Uhmm uhmm.

110 Teacher: And what color did you say it was, Tom?

111 Tom: It was brownish . . . light brown and dark brown . . . with lines on it.

112 Teacher: O.K. And why would that happen? Why is it that color?

113 Tom: It hides in the leaves and under water.

114 Teacher: Very good Tom. Thank you. Any other . . . Brian?

115 Brian: Well we saw a june bug.

116 Teacher: A june bug, uh huh?

117 Brian: It had all these legs up at the front and . . .

118 Teacher: I'm sorry, I don't think everyone's ready. Can you say that again please?

119 Brian: We had a june bug and it had all its legs up in the front part of its body instead of being all spread out.

120 Teacher: What else can you tell us about . . . perhaps its color?

121 Brian: Well, it was a greenish color with black stripes.

122 Teacher: Did anyone else find one of those? You did?

123 Student: I was with him.

124 Teacher: O.K., and that's why you found him. O.K., Ben?

125 Ben: Uh, we had a minnow or a fry . . . the lady told us that one . . . and uhmm, it was green . . . whitish grey on the bottom and black stripes on the back . . . and sort of a darkish black head and . . . that's it.

126 Teacher: O.K., why do you think he was that color?

127 Ben: To blend in with the dirt . . . or the seaweed . . . or the surroundings.

128 Teacher: O.K., what we've been seeing is that color can have an effect. The color of the organism blends in with the surroundings. Therefore, if the surroundings change . . . as when we looked at the moth . . . the white moth on the soot covered birch tree O.K.? He changed because the color of his environment changed. And the same thing with many of the organisms that we saw today. Did you have anything more? Can you tell us what you saw?

129 Student: What was it . . . the dragonfly . . .

130 Teacher: The dragonfly nymph?

131 Student: Yeah. It was fairly large. At first we had a mayfly and . . . then the dragonfly nymph tried to eat it . . . they tried to eat each other.

132 Student: They didn't like each other.

133 Teacher: They didn't get along together.

134 Student: No. And so we had to pull one out.

135 Teacher: And which one did you pull out?

136 Student: The mayfly. Because he wanted more space and . . . and, uh, we decided to. And we had a minnow in there too . . . so we just thought to . . .

137 Teacher: O.K. Yes, go ahead.

138 Student: We had a snail and he kept trying to crawl . . . we had one dish and then we had another one. He kept trying to crawl into the other one where the minnow was.

A general announcement comes through the P.A. system, causing some discussion among the students.

139 Teacher: O.K. Trish, go ahead. Is everyone listening?

140 Trish: I found a Lake trout or a frew fish.

141 Teacher: A fry fish, yes?

142 Trish: A fry fish. And . . . uh . . . it was green and silver . . . and . . . uh . . . it had those colors because it blended in with the seaweed at the bottom of the lake we thought.

143 Teacher: Uhmm uhmm. Christine, did you see anythng that you could tell us about?

144 Christine: Well, I was with Tom and we had the snail.

145 Teacher: You had the snail also. Yes, go ahead?

146 Student: Well, we had a sideswimmer and it always swimmed on its side.

147 Teacher: You had a sideswimmer. What else can you tell us about it?

148 Student: It looked like a cricket kinda.

149 Teacher: Uh huh?

150 Student: And . . . (pause)

151 Teacher: That's about it? Did anyone else have a sideswimmer? No? Denny, did you have something?

152 Denny: (inaudible)

153 Student: Excuse me, can everyone hear Denny?

154 Students: No.

155 Denny: (inaudible) (the bell sounds)

156 Teacher: O.K., if you'd like to go back to your tables, I'll dismiss you one by one when your tables are all neat and clean.

The lesson ends

Appendix B

Discussion of Lesson 2
84-10-25, 7:00 - 8:30 p.m.

C - Clinical Supervisor
T - (Teacher) Wendy

	Transcription	Analytical Comments
1 C:	What I'd like to attempt to do in the analysis here is to walk through the transcription of the lesson and I'd like you to reflect on what happened and almost, if you can, put yourself right back into the situation. Let yourself replay it in your head, not only reading it . . . So you know what I'm saying? It should be fresh enough so that you can almost relive it. So that you might even visualize some of the things that happened in the lesson.	In order to expose Wendy's thoughts at the time of teaching the supervisor invites her to relive the lesson.
2 T:	O.K.	
3 C:	Uhm, first of all we could just speak generally about it. Did you feel nervous? You didn't look nervous at all.	Episode 1: TEACHER CONCERNS
4 T:	I was extremely nervous.	
5 C:	I thought you would be, judging from our conversation prior to it. But I didn't ask that question because you looked nervous. You didn't look nervous at all.	
6 T:	I was extremely nervous. I was really surprised that my voice wasn't shaking. Quite often when I am nervous and I get up to speak, my voice starts to tremble. I didn't notice that on the tape.	Wendy's initial comments indicate that the anxiety associated with this teaching exercise was very high.
7 C:	Neither did I. I didn't notice any tremble on the tape at all. But did the nervousness persist, or did it gradually leave you?	

8 T: No, it left after a while and then I notice that it . . . I think it was when I brought the children back up to the front after the activity, that I felt a little bit nervous then. And toward the end, I felt that I was faltering.

9 C: Well, those are only natural feelings. I mean, they're perfectly natural and you can expect that to happen . . . you know, for a long time. After you're really familiar with a group, when you've been teaching for a few months in the school after the beginning of the year, you start to ease up a bit. But you're still usually anxious about your teaching and about the way your lessons are going to go and that never leaves you. I still get very anxious and nervous before I begin, and then it gradually leaves me. At any rate, just while we're talking about it generally, were you pretty pleased with it?

The supervisor's construction here may serve two purposes: first, to assure Wendy that it is normal to be anxious about teaching; second, to imply that there are good reasons for being anxious.

10 T: Uhm, I actually thought I didn't do that badly. I thought I would really . . . I had visions of messing it up totally, and . . . you know, listening to it . . . I didn't think I did that badly. I mean, I certainly can see what could be improved, but I didn't think it was as bad as what I expect I would do.

". . . messing it up totally . . ." illustrates, again, the anxiety of the situation.

11 C: What were you concerned about before?

12 T: I would say mainly forgetting. I have that problem sometimes . . . when I'm really nervous my mind blanks out and I can't remember what I'm talking about. I think also, ahead of time, I was thinking perhaps that I would have difficulty explaining to the children. You know, for them to

The first concern has to do with the subject matter of the lesson.

understand the concepts I was trying to get across. Because I wasn't sure of the group.

13 C: What did you think of that concern afterwards? Have you satisfied yourself?

14 T: I think so. I spent a lot of time preparing . . . to the extent that I that I read over the lesson plan quite a bit and sort of . . .

15 C: Walked through it in your mind?

16 T: Yes, walked through it at home. And so I felt a little bit more comfortable with the material. I think that that was another thing I was probably worried about . . . was the material. Science isn't my best subject . . . and I was a little worried about something coming up and I wouldn't know enough or I wouldn't know how to handle it.

This, Wendy associates with her lack of confidence in science.

17 C: I see. Did you have science in high school? You must have hey?

18 T: Kind of, sort of but not really. I . . . I have my British Columbia grade eleven biology . . . and then I came here to get my upgrading from B.C. to Alberta standards. In order to enter university I took Biology something . . . at night school.

19 C: At Mount Royal?

20 T: No, at Western Canada High School. That was eleven years ago, so it's been a long time.

21 C: It was probably Biology 30.

22 T: Yes, maybe. Biology 30.

23 C: And since then have you had any science courses?

24 T: No.	
25 C: And is that why you're feeling uncomfortable?	
26 T: Yes, I just didn't feel that I had enough background in the subject. If something came up during the lesson, I thought I wouldn't know, or I wouldn't remember.	Wendy's construction hints toward a conception of science teaching as a matter of remembering the "right answers" to questions that might come up.
27 C: Has you opinon changed in the course of this lesson? (laughing)	
28 T: Oh yes right, I know so much more about science now. No . . . I feel more comfortable teaching elementary students and you know, I felt more comfortable doing this because I was quite prepared with the lesson you had set out there. And I thought that was really good.	
29 C: But . . . uhm, being worried about whether you could answer a question asked by the students . . . uh . . . From the amount you've learned about the elementary science program and the emphasis on teaching elementary science . . . uh, does that lessen your concern at all about the content? I mean, the emphasis being what we call this "process skill" approach . . . Does that sort of decrease your burden?	The supervisor refers to a different conception of science teaching upon which the methods course was based. This view has science teaching as a matter of establishing information in the classroom.
30 T: I think so. Like I feel much more comfortable about science than what I did before. You know, just from what I've learned in class. I feel that I actually look forward to going to science class so that I can learn things to teach kids in the elementary school. You know, I don't hate science any more.	
31 C: That's good to hear.	

32 T: Does that answer what you were . . .

33 C: Yes. You weren't concerned about discipline.

34 T: To a certain extent. Only because I knew I was stepping into Mr. X's class . . . and whether I should do the same type of things he was doing or not. Like, I wasn't really concerned about the kids getting out of hand. I didn't think they would. I thought even if they did start to act up I could probably handle that. But I was just worried that maybe I shouldn't be behaving the same way he was . . . because it wasn't my place . . . if you know what I mean?

Wendy was not concerned about managing the classroom, at least not about her ability to manage students. Rather, her concern focused on being in the situation of not knowing her students, and their not knowing her.

35 C: I see. Did you find yourself trying to emulate Mr. X at all? Let me rephrase the question. Did you feel autonomous . . . that this was you working and you weren't trying to fill any one's shoes at the time?

36 T: At the time, yes. In fact I think I tried not to copy what he had done. I felt that I didn't have the familiarity with the children so that they didn't know me well enough to try to do the same thing.

End of Episode 1

37 C: I think it's better to be natural like you were. Well, that's great. Now, I think we'll probably walk through this fairly slowly at first and I'm not too sure how long we'll take with it, but let's begin. I'd like you to, as I was saying, try to recall what you were thinking at the time as we get into the flow of the discourse O.K.? And why you reacted in certain ways at the time. But that's only part of it. I'd like you to also think about the flow of events from your point of view now,

a couple of days later. So if things come into your mind now . . . that didn't come into your mind at the time of teaching, then by all means raise them.

38 T: O.K.

Episode 2:
ESTABLISHING THE "HOOK"

Discussion in this episode centers around the introduction to the lesson (page 85, #3 to page 86, #19)

39 C: O.K., well let's begin just where you begin speaking here on page (85) #3. The kids were peeking in the buckets just while Mr. X was introducing you, is that right? Did you want to read out loud, or would you like me to?

40 T: Whatever.

"Establishing the hook" consists of reviewing, with the children, previous classroom discussion of their isopod experiment.

41 C: O.K., "I see you've already been peeking in there . . . that's part of our project. That's alright. You've been looking at environmental factors I've been told. Does anyone want to tell me what an environmental factor is? Yes?" And the student says, "Air pollution." And you say, "Air pollution, O.K." And another student says, "Water pollution." "Sorry?" "Water pollution." "Water pollution, O.K. I think you were perhaps using isopods. Were you working with isopods? What sort of environmental factors did you find? Yes Harry?" "That they like going to corners and dim parts of the runway." So what was the environmental factor?" "That they like to go to the dim parts." "The dim parts. Yes?" Does anything cross your mind yet?

42 T: Do you want me just to cut in on you as you're going along?

43 C: Yes.

Reflective Cycle 1

44 T: O.K. Well the first thing I notice is that I say "O.K." far too often . . . which I wasn't aware of. But when I started this, I was very unsure how to open the lesson. How to . . .

other than just say, "You've been talking about environmental factors," I really didn't feel that I had a good opening line. And I find this all the way through. Like, I wasn't listening all that closely to what the kids were saying. Like, my response to them . . . I *was* listening to them, but I *didn't* respond in that manner.

Ph. I Initial Problem Setting
Wendy frames the first problem she sees in her performance: she was not responding appropriately to what the students were saying. She goes on to locate an example which supports her proposition.

45 C: Why do you say that?

46 T: Well, there's one instance that I noticed later on when I cut in on a student as he was talking. But that was when he had answered with exactly what I was looking for.

47 C: And you got excited.

48 T: Yes. But I found I was repeating the students' answers quite a bit. Now whether that's wrong or right, *I thought I should have tried to get the kids to say a little bit more.*"

She identifies a pattern in her teaching and then formulates an *implication(1)* for practice, that is, the first "I should have . . . "

49 C: Why would you want to do that?

50 T: To clarify their meaning to both myself and the rest of the class, and try to see why they were coming up with those answers.

51 C: Now, can you see an example here on the page that would illustrate that?

52 T: Well, O.K., with these first two -- air pollution and water pollution -- I understood where they were coming from, but whether the rest of the class did or not . . . And that wasn't what I was looking for; that's why I brought up isopods.

Here, Wendy rationalizes her action. At the time of teaching her concern was with having the pupils make explicit what *she* was looking for.

53 C: Oh I see. So "air pollution" and "water pollution" really didn't . . .

really weren't examples of environmental factors?

54 T: They weren't the ones I was looking for. I wanted to get them on to thinking about the light, and what they had been doing with isopods.

Her conclusion(1) is that the students didn't make the "connection" she was after.

55 C: Did air pollution and water pollution, given as examples of an environmental factor, satisfy what you expected them to know about the word, or the term "environmental factor?"

The issue becomes whether or not the students demonstrate that they understand what they need to about the concept "environmental factor."

56 T: I didn't expect them to come out with things like that.

57 C: Yes, neither did I.

58 T: I found that several times throughout this . . . that they had a lot more knowledge than what I would have expected them to have at that stage.

59 C: Was that scary for you?

60 T: Yes, definitely.

61 C: I guess on the one hand you want them to tell you what they know, but you want to be able to handle it at the same time.

62 T: That's right.

63 C: And to sort of shape it into the meaning you want. O.K.

64 T: Again, I can see some of this causing me to be uneasy because I didn't know what they'd covered already, or what they'd had previously.

65 C: Sure. Actually, right now in terms of your development, you know very little about kids compared to what you will know about them.

66 T: As far as what they learn in school. Also, down here where the one fellow said that the isopods like to go to the dim parts, I think in that case . . . because that was pretty close to what we were looking for, I should have gotten him to give a little bit more on that.

Wendy revisits implication(1).

67 C: How could you have done that?

68 T: Right now I honestly don't know. Perhaps get him to explain it in a different way or . . .

69 C: O.K. . . .

70 T: On page (86) #12.

71 C: Right. I'm just looking up into the discourse that happens just before that point. To just briefly summarize it, you ask for examples of environmental factors, probably to get to their understanding of the term or the concept. And they give you things that you were expecting . . . and you go with the flow. "Air pollution, O.K." Someone else says, "Water pollution". Do you see what I mean? And then you make an adjustment . . .

Ph. II Reframing

The supervisor begins to reframe the situation. (Clue 1)

72 T: To get them back on track.

73 C: To get them back on track. So, "I think you were perhaps using isopods. Were you working with isopods?" They must have nodded their heads, right? "What sort of environmental factors did you find? Yes, Harry?" So we're back on to environmental factors and isopods, in the context of isopods, and we're looking for light, moisture, temperature and things like that.

74 T: Actually just light. They hadn't done the other two.

75 C: O.K. "They like going to the corners and usually the dim parts of the runway." Well, I suppose what he said isn't really an environmental factor is it?

76 T: No. I was trying to get him to tell me . . . not where they had gone, but . . .

77 C: But to just use the word "light". And so what's wrong with what you did "So what's the environmental factor?"

The supervisor stresses the intention of the action, as the basis for evaluating Wendy's question.

78 T: And he just repeated what he had said before, basically. Except he did shorten it. I suppose I was still concerned at that time . . . I was still very nervous at that time and I was trying to get him to say, "light" and nothing else, sort of thing.

79 C: Well, you see it's not as bad as you think . . . I don't think. He's talking about their activity and you want him to say, "light". "So what was the environmental factor?" You're focusing him in and then he repeats the same thing.

Ph. III Resolve

80 T: Well, actually, when he answers he does say that they like to go to the dim parts, so . . . seeing it now like . . . he has picked out what I was looking for.

Wendy arrives at a new conclusion(2), namely that the student did make the proper connection.

81 C: O.K. (pause) And things continue to flow along quite nicely. You're shaping the ideas, I think, quite nicely. Teacher: "The dim parts. Yes?" And then, "Isopods prefer finer sand and dimmer parts." And then, "Anything else?", and silence after that. How do you read that?

82 T: (pause) I don't remember from the actual time. Uh, . . .

83 C: It was sort of like . . . that was it. They'd given you everything that they had. "Would there be any other environmental factors that you could think of?" Tom says "Well the babies aren't used to the dim light and so they move to the light. And I don't know . . ."	
84 T: I actually think I should have left it the way it was instead of, you know, kept pushing for something . . . else for them to say, "light" and nothing else. And I think that's . . . from my understanding in looking at it now . . . that's what I was doing. I didn't accept what they said about going to the dim parts. I wanted them to explicitly say "light" and nothing else.	This new view of Wendy's gives rise to a new implication(2) that is, a different "I should have . . ." (Clue 3)
85 C: Well do you think that you pushed them too hard?	Return to Ph. II Reframing
86 T: Actually I don't think so, no. Because they didn't . . . they didn't react badly to it or anything. They were still all with me and everything at the time, so . . .	The supervisor then begins the construction of yet another frame, this time utilising the principle: to "push" is to challenge, and to challenge is good. (Clue 1)
87 C: Do you think that it's important to push them a little bit?	
88 T: In some cases, yes.	
89 C: Well, you want to deliver sort of a challenge, don't you? Give them something to do and have a worthwhile purpose for them doing it? I don't know if they'd like it very much if you gave them all the answers.	
90 T: No, no. Certainly not. I can see that.	
91 C: In fact, that might really backfire, you know. If your were to give them all the answers.	To illustrate the principle he poses an hypothetical teaching pattern, and Wendy names the effect.
92 T: It would be boring for them.	

93 C: Let them off the hook a little too easily. What do you think would happen?

94 T: I think they'd get distracted very easily. They wouldn't, on their own . . . they wouldn't develop because children usually have that curiosity for starters . . . it's teachers who end up stifling it in them. That's my personal opinion, however.

She associates the "supplying all the answers" pattern with "stifling children's curiosty." She plays out the consequences thus.

95 C: What makes you say that?

Here, Wendy relies on her own experience as a student to formulate the pupils' perspective. This allows her to judge her own teaching in a new way. (Clue 4)

96 T: Why do I say that?

97 C: Your own experience?

98 T: My own experience, yes.

99 C: What happened?

100 T: Nothing in particular that I can remember, but I know that I was very enthusiastic when I started school, and I was until about junior high.

101 C: Uhmm uhmm.

102 T: And then I had a lot of old teachers who really didn't care what you were doing . . . and . . . I used to get away with a few tricks . . . you know, you'd hand in an assignment with the middle part missing out of it and they'd never notice.

103 C: Oh heck. Gee whiz.

104 T: And I found that they weren't interested in what you were doing. They had their list of what to get through and that was it. And they really didn't care how they did it. That sort of really turned me off for a while.

105 C: They didn't challenge you.

106 T: No, not at all.

107 C: O.K., well I like what you're doing here . . . pushing them a bit. And to be honest with you, that . . . you know that your questioning technique is quite clear. I think the questions are clearly delivered. And when something isn't quite right, and you want to communicate that you're pushing . . . that comes across quite clearly to kids. I think due to the evidence we have here. They are actually satisfying your push. Do you know what I mean?"

The supervisor refers, loosely, back to the evidence and judges the question on the basis of his "pushing" metaphor.

108 T: Uhmm uhmm.

109 C: A lot of times beginning teachers have problems with question. They find that their questions aren't explicit enough . . . that the meaning of the question is slightly ambiguous, and the kids struggle to find out what it is that the teacher wants. And so quite often you'll find that a beginning teacher will ask a question and then there's silence. Nobody knows what he wants. So he repeats it in a different way. . . see? Well, that's not really happening as far as I can see anyway in this first part.

He continues this reframing/problem setting by creating a third lens with which to view Wendy's questioning technique, this time in terms of the ambiguity of questions.

Again, he contrasts an hypothetical frame with what he finds in Wendy's teaching.

110 T: Is that a bad thing to do though?

Wendy explores the supervisor's frame.

111 C: To rephrase? Well it's not a bad thing to do . . . I think it's a good thing to realize that the question has been ambiguous . . . in which case it's an excellent thing to do . . . rephrase the question. But I think it's better if you can anticipate . . .

112 T: And avoid that for starters.

113 C: And avoid that, yes. But I don't see a problem with your questioning here. Perhaps you'll want to keep that in mind and raise something later on if you want.

Ph. III Resolve
The supervisor states his conclusion about Wendy's skill in questioning, drawing this cycle to its end.

114 T: O.K.

115 C: Let's just continue then. "¡Anything else? No? O.K., we're going to look at environmental factors in a little bit different way." Now the lesson sort of shifts here doesn't it.

116 T: Uhmm uhmm. That was the beginning of my introduction. . . what I was going to be going into.

117 C: So, in the terms we've used in class, you've done your "hook" -- you've hooked up to what the kids have done previously in class. So you have them set for the lesson, right? Now, you were wondering a minute ago about your opening statement. . . "You've been looking at environmental factors, I've been told." Well, this whole little episode has occurred in twenty or thirty seconds . . . somewhere in there. And I think it's a nice little link . . . they're hooked right into the frame of mind that they left their last class with. And now you're ready to begin. I guess what I mean to say is that perhaps it would be more useful to think of the entire piece of talk and how it functions, rather than just your opening comment. O.K.?

The supervisor refers back to Wendy's comment in #44, "I really didn't feel that I had a good opening line." He confronts her frame with one of his own in order to obtain a new interpretation of the "introduction" of the lesson.

118 T: The whole introduction then.

119 C: Right, the train of thought. But let me just get this straight. When you began the introduction to this

lesson, were you satisfied that the kids knew what an environmental factor is?	
120 T: Yes.	Wendy's conclusion here is different from that in #54.
121 C: Good. "You looked at light with the isopods and that was an environmental factor. We're going to look at a slightly different twist to environmental factors. We're going to look at protective coloring O.K.? And I'm going to begin by telling you just a bit of a story . . . and maybe these pictures will give you a little bit of a hint of what we're going to be looking at, O.K.? This basically shows the industrial revolution. Does anyone happen to know what it is?"	End of Reflective Cycle 1 Episode 3: THE INDUSTRIAL REVOLUTION Reflective Cycle 2 Ph. I Initial Problem Setting This question and the pause that followed it are the phenomena that are of interest here.
122 T: I thought I was dead there.	
123 C: You were dead? Because they didn't know what the industrial revolution was?	The supervisor poses a tentative conclusion(1) about the pause.
124 T: They didn't know, but once we started talking about it, it seemed as if they had, at least, some notion of what it was. Now I think also that what I was thinking of at the time was the other lesson when the same question was asked. There was a terrific response. I was hoping that I would have the same thing. When there was silence, I thought . . .	
125 C: What do I do now? Can you remember how long the silence was?	
126 T: At the time, an eternity. From listening to it . . . I honestly don't think it was that long.	
127 C: I think about three or four seconds.	
128 T: Yes. It seemed like forever, though.	

129 C: The question is pretty precise. "This basically shows the industrial revolution" . . . all the smoke stacks and the smoke . . . "Does anyone know what that is?" That, referring to the industrial revolution . . . coming through quite nicely in the conversation. So I don't think it was an ambiguous question at all that led to the silence.	Ph. II Reframing The supervisor is the first to attempt an explanation. He constructs a frame in order to test his hypothesis that the pause is the consequent of an ambiguous "that." (Clue 1)
130 T: No, I think they just didn't know the term "industrial revolution".	Wendy offers her explanation, and she draws out evidence from the lesson transcription to support her frame (1).
131 C: I agree with you when you say that in the next little piece of conversation, things started to click. Now, can you show me what it was that made you think that?	
132 T: I'd say, mainly, when they started coming up with things like, "There was lots of smog and smoke in the air," and the fact that there wasn't any pollution laws.	
133 C: Wasn't that interesting?	
134 T: Yes, I was surprised at that. That they would even know such things as that . . . I suppose so.	
135 C: You see how quickly you get to know them.	
136 T: Yes. But the fact that they did realize that there was a little pollution . . . now that, again, they could have been picking up from the picture, but that was one of the reasons it was there so . . .	She reframes again, exploring the basis upon which students might have received their information (frame 2).
137 C: Sure, and it wasn't our purpose to teach about the industrial revolution either. One could really get hung up on a tangent if one went into that.	

138 T: They seemed to understand what I was getting at . . . the smoke in the air and so on.

Conclusion(2)
(Clue 3 - a new conclusion about the problematic phenomenon is reached.)

139 C: Sure. So when they started talking about smog, you felt a little better. And you say, "Yes, there was indeed. Tom?" And unfortunately, someone coughed just as Tom was speaking. But you come right back and said, "I'm sorry, I couldn't hear that." What was the function of that statement?

140 T: For having him repeat it?

141 C: Yes.

142 T: Because I didn't hear him for starters. I'm not sure if others were talking . . .

143 C: No, I think it was just a cough.

144 T: Just a cough. Well, I didn't hear what he had said, so I asked him to repeat it.

145 C: O.K. Looking back at it now, do you think that that kind of statement from you would have an effect on the class?

146 T: On him and the rest of the students? O.K., I like to use something like that myself when the other kids are talking.

147 C: And it does have an effect?

148 T: I think it does, yes.

149 C: O.K., we'll get to those other spots later on and revisit that notion. O.K. "The smoke goes into the sky," Tom says. "Yes it does. And Nancy?" "Sometimes they might put the chimneys really high so the smoke does way up." Isn't that interesting? Come to think of it, the chimneys in that picture were really tall.

The supervisor suggests that this evidence supports Wendy's frame (2).

150 T: They were very tall, yeah. I can see where they were getting their answers from. It was pretty clear at that time. They were catching on to the concept that I was looking for.	Ph. III Resolve Wendy accepts the proposition that students were getting clues from the pictures, but since they were getting the "right" clues, she maintains the belief that they understood the concept, conclusion(2).
151 C: Sure, and in fact, looking back on it one didn't really even need to use the term "Industrial Revolution," right?	
152 T: That's right.	
153 C: You know, it really has nothing to do with the concept.	
154 T: That's why I started to feel better once I got into it. You know, I got to thinking that it doesn't really matter what I call it . . . as long as they understand that there was a lot of smoke and pollution in the air that, once it got on to the birch trees, caused soot.	End of Reflective Cycle 2
155 C: Right. So again you're focusing them in. Now this is the way I view it . . . and I don't know if this will be useful for you or not, but I sort of view teaching at least in part as supplying puzzle pieces . . . and the kids are supposed to put the puzzle together. So I view this as being part of the puzzle . . . the bit about the moth . . . to know that there was lots of smoke in the air, and that that hadn't been occurring before. So in a sense, not really the idea of industrial revolution, but when the factories were built, there started to be a lot of smoke in the air.	The supervisor brings Episode 3 to a close by looking at the "industrial revolution" issue in terms of the logical requirements for students to understand the lesson.
156 T: Right.	
157 C: Right, and that's necessary for the kids to start thinking of changing environmental factors.	
158 T: Uhmm uhmm.	

Episode 4:
REPHRASING IN CONVERSATION

159 C: Alright. So the smoke goes into the sky . . . and we talk about chimneys . . . and, "Anything else you notice about these pictures? I suppose I'm standing in front of them." . . . and you move to the side . . .

160 T: Which I was (laughs) . . .

161 C: Were you?

162 T: Yes. I was maybe just in the middle of them, but children from both sides wouldn't have been able to see them. And it didn't dawn on me until after I'd been talking for a few minutes. And then, better move.

163 C: It was very smoothly done. In fact I didn't notice that you were standing in front of the picture to be honest with you. I guess I was concentrating on other things. O.K., "Yes they do. And as several of you have mentioned, there's quite a bit of smog and pollution there. O.K., I want to tell you a bit of a story. This is a birch tree. It sort of looks like a birch tree . . . it is bark from a tree, and as you notice it's white. And this is the moth which they had. This species was found in England at the time. Now this moth . . . this is one of its favorite resting spots. What do you notice?"

Reflective Cycle 3

Ph. I Initial Problem Setting

164 T: I didn't think I'd done that part too smoothly there. I felt I was sort of stumbling around for words to explain it. They followed what I was saying, so . . .

165 C: You mean in spite of the pauses and things?

166 T: Yes. Like I think what I was doing there was I was stopping and sort of almost trying to rephrase what I was saying so it would come out fluently

rather than . . . I felt I was being
very disjointed at the time.

167 C: Did you?

168 T: Yes I did at the time. Reading it,
it doesn't look all that bad. But I
know that I felt at the time like I
was very disjointed and that they're
not going to understand what I'm
saying here . . . I've got this and
I've got this and . . .

169 C: You were very aware of your
audience . . . how your audience
hears your words.

Ph. II Reframing

(Clue 1)

170 T: Uhmm uhmm.

171 C: It's a very good sign. I would
suggest not to feel uncomfortable
about feeling that you have to
rephrase and correct your language
as you continue, because that is
sort of natural in conversation.
Conversation is sort of self
correcting . . . I mean oral
language has that feature. Listen
to me right now, O.K.?

Ph. III Resolve

172 T: O.K.

173 C: But that, I suppose, is one of the
worries of teachers. You know, in
setting up their questioning or just
their oral discourse in general.
How to make it clear? But you
see, it doesn't become clear unless
one is worried about making it clear.
You see? So it's good to think about.
So you held up the moth and said,
"What do you notice?" And Jane comes
up with, "It blends in with the bark."
That must have been pretty nice at
the time.

End of Reflective Cycle 3

174 T: Oh, it was excellent. Good for you
child! Yes they seemed to follow
this really well . . . I was really
pleased with it.

Episode 5:
THE INTERRUPTION

175 C: O.K., would you like to go on?	
176 T: O.K. "They blend in, so what good would this do for them?" I notice when re-reading it here that I've reworded it again. When I say, "How would this help him?"	
177 C: O.K.	
178 T: And I was just trying to make it clear to them what I was looking for. This is where I cut in on a student. "It would give him camouflage so that his predators couldn't . . ." I got so excited because he'd hit it right on. Exactly. I realized, listening to it, but I wasn't aware at the time that I had cut him off. But you can hear on the tape that he's still finishing his sentence when I blurt it out.	Reflective Cycle 4 Ph. I Initial Problem Setting Wendy names the problematic phenomenon.
179 C: Well, why do you feel badly about that?	
180 T: Because I think it's rude to interrupt people when they're speaking.	Conclusion(1)
181 C: Do you think it would have an effect on him?	
182 T: Well sure. Next time, perhaps he may still answer your question, but he may not . . . you know, elaborate as much with what he's saying, or he may . . . eventually, if you continue to do that, he may not bother to answer. If someone's going to cut you short as soon as you start to talk. That's the way I look at it.	Wendy looks at her teaching behavior from the student's perspective. She names the pupil consequent. (Clue 2)
183 C: Do you think that . . . uh . . . Could I talk about a sense of belonging, or ownership of a response? It's mine. I'm sitting	Ph. II Reframing The supervisor attempts to obtain a deeper understanding

in your room and I've got my idea and I want you to accept it. I want to feel worthwhile, type of thing?	from the student's perspective. (Clue 1)
184 T: I don't think I follow what you're getting at.	
185 C: Well let me think of another way to put this. You see, you don't want to interrupt the kids . . . and you want them to talk and to answer your questions and so on . . . But I'm trying to get at what that means to kids. If they're willing, number one . . . and if they get a sense of pride, number two, out of their ideas.	
186 T: Well, if I listen to the whole thing that they're saying . . . to me, hopefully they're thinking that I respect their opinion. I respect what they have to say. Therefore they will give me input and they will sit and try to think out the answers and then give me . . .	
187 C: O.K., good. Now why is that important to you as a teacher?	
188 T: How can I explain this?	
189 C: That's a tough one isn't it? You're having the same trouble I was.	
190 T: I don't know . . . I think it's got something to do with . . . I really don't know how to explain this . . . like I really like to see kids curious and motivated to do something.	
191 C: And to be challenged?	
192 T: Right	
193 C: O.K., now in your experience as a student, were you ever cut off?	The supervisor invites Wendy to reflect on her own experience as a student. (Clue 4)
194 T: Probably quite a bit.	

195 C: And that had an effect on you?

196 T: Uhmm uhmm. Things like that even still happen today where certain professors are looking for a particular answer . . . and it doesn't matter what you say, they will just reword it so it comes out in the way they wanted it. And I don't think that's a good technique. 'Cause everyone eventually shuts up. No one says anything any more . . . What's the point when he's just going to twist it around? I think it's poor questioning technique on the part of the person who's asking the question . . . if they can't get their question across so that it's clear or, you know, directed in the area that they want to go in.

197 C: So that it's possible to answer the question?

198 T: Right. And if you do happen to answer with something that they weren't looking for, rather than rewording it . . . somehow ask another type of question or do some sort of directional type of thing to get back to what you were looking for . . . not just saying, "No, this is what I'm looking for. What you said doesn't matter."

199 C: So it's letting your kids count. Ph. III Resolve

200 T: Exactly. Conclusion(2)

(Clue 3)

201 C: You don't have to go to a teaching college for four years to find out that. O.K. But I suppose with continued treatment like that, kids would probably clam up a little bit. I'm not intending to say that it was bad. It wasn't bad because you were excited. You see what you've done now is come to notice it and think of it in a new way . . . thinking of the effects of it. And it will very

likely affect the way in which you work in the future.

202 T: Well, I definitely . . . I mean going through this, I don't think I should have done that at all. I really think that was bad.

Wendy hasn't really changed her implication here, although she may feel more strongly about it now.

203 C: It only happened once.

204 T: Well I know, but still.

205 C: Somebody told me once that if I wanted to learn how to fly, the thing to do was to throw myself on the floor. Think about learning anything. You just don't learn if you don't make mistakes.

206 T: Well, I'm well aware of that. In most cases, it's the best way to learn.

End of Reflective Cycle 4

207 C: Sure it is. I think that it's excellent that you reflect on it in the way you do. Because you notice it, you see . . . and when you're beginning teaching, you just don't improve until you notice the mistakes that you make. And maybe they're only mistakes in certain people's eyes, but it's your eyes that count . . . the way in which you think about your teaching. I guess what I'm trying to say is that some people might be oblivious to the things that they do and the effect that they have in the classroom. And that's sort of what this is all about . . . trying to get people to consider the effects of their behavior as a teacher in these ways. O.K. . . . "Exactly. Very good. Did everyone hear that?" "Uhmm uhmm?" And then you come back with "It would protect it from its predators, therefore he would have a better chance for survival. O.K.? Well, what happened, as you noticed there was so much pollution there," . . . and you held up the

Episode 6:
PROTECTIVE COLORATION/
BIOLOGICAL ADAPTATION

bark . . . "What happened to the trees?" Now, just before we continue here, do you think that all the kids made the connection that in being protected from predators -- being invisible, so to speak -- that an organism has a better chance for survival?

Reflective Cycle 5

Ph. I Initial Problem Setting

208 T: I'm not sure whether they are totally aware of it at this stage. Later on I think that they come to that conclusion. I can't honestly say that I know whether they understand at this particular time.

209 C: O.K., the reason I ask that is because the complete thought there comes from the teacher. And it's just that when I'm teaching, and I find that I have to complete the thought, I always wonder if everyone is with me. Did you wonder that at the time?

210 T: I really can't say. I think that what I was doing here was more or less repeating what the fellow who I cut in on said.

Ph. II Reframing
(Clue 1)

211 C: O.K.

212 T: And just continuing on from there.

213 C: So there's a pretty good chance that the kids understand. Well, let's just go on into the evidence a little more and keep that question in mind, O.K.?

Tentative conclusion(1)

214 T: O.K.

215 C: So, "So what happened to the trees?" And Dan said, "They all turned darker," so he's got the connection . . . the smoke in the air and the white bark . . . and he probably knows all about the way in which dust settles out in the house and all that . . .

216 T: I had the prop there too, so that's probably helping.

217 C: Right. "That's right. All covered in soot and they're quite a bit darker." And then holding up the white moth to the dark bark . . . and Dick says, "No camouflage." He's got it right on.

218 T: Uhmm uhmm.

219 C: "Right. What was that again Dick?" "He sticks out like a sore thumb, right? All the birds or any other predators who want to eat him can spot him from quite a ways away, right? There would be no problem. So what do you think would happen to that moth?" Any thoughts on that?

220 T: The kid's pretty bright. He picked up on that right away. Uhmm, O.K., as I went through this after, this fellow here did come out with the example I was looking for, I just went on to explain a little bit further . . . in case, you know, some of the kids didn't quite pick up on the fact of predators and, you know, camouflage and things like that. My next little blurb there was just trying to explain it further for them.

221 C: O.K. Again, that might have something to do with this wondering whether they made the connection between protective coloration, predators and survival.

222 T: Uhmm uhmm.

223 C: O.K., now did that make you feel more comfortable about their understanding the basic . . . sort of bottom-line understanding in the lesson? Did your elaboration there help?

The supervisor attempts to reframe again.

224 T: I think that just by the time that
they sort of got to those
conclusions . . . and then I sort of
rephrased it in so many words . . .
just to make it a little bit
clearer, I felt at that time
that they knew exactly where it was
headed and what I was talking about.

Conclusion(1)

225 C: O.K.

226 T: Is that what you're looking for?

227 C: Yes, in part. I'm also wondering
if there might be another way of
kind of summing things up. You
know when you're teaching . . .
this gets back to one of the things
that Dr. X was telling us one time
. . . that it's a good idea to review,
or summarize, what you've covered
throughout the lesson . . .

228 T: As you're going along . . .

229 C: Right. That's what I see you doing
here . . . sort of summing up the idea
and making sure that it sits O.K.

230 T: Right.

231 C: Now I'm just wondering if there
might be another way of doing that.

232 T: Rather than me doing it, I could
ask the students to?

233 C: Would there be any advantage to
doing it that way?

234 T: Well, by having them say it, I
would have the security of knowing
that they do know what I'm talking
about.

235 C: Yes, that might be a neat little
technique to use in teaching . . .
to say, "O.K., now who can summarize
what we've said so far?", or, "Who

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can tell me again what would happen if the moth was blue and sat on the grass?", or something like that.

236 T: So you're saying that it would be a much better technique to have the children do it than to do it yourself.

Conclusion(2)

(Clue 3)

237 C: Well, not necessarily. I'm just exploring different ways of doing it and wondering about the effects of doing it in different ways.

238 T: Uhmm uhmm.

End of Reflective Cycle 5

239 C: Well, here we go . . . as a matter of fact. "What do you think happened to the moth? I'm sorry, is it Joe?" "Joel." And Joel says, "It would probably die." "O.K., what else could happen?" "He could change colors?" "Right, and what color would he go to?" "O.K., what else could happen?"

240 T: Well, one thing that I noticed when I was looking at this myself is that I perhaps should have acknowledged the fact that he said, "He'd die." Rather than saying, "O.K., what else could happen?"

Reflective Cycle 6

Ph. I Initial Problem Setting

Implication(1)

241 C: What's the effect of saying, "O.K., what else could happen?"

242 T: Well, to me, reading it and listening to it, it almost seems as if I said "O.K., fine . . . that's an answer, but that's not what I wanted." Or, "That's not right."

Conclusion(1)

And then just sort of go on to another one.

243 C: O.K.

244 T: Whereas . . . you know, I should have accepted that . . . and I thought that unless something else happened to permit him to survive. I should have worked with that a

Wendy has already reflected on this incident from the perspective of the student. (Clue 2) little bit further . . . I think it was just a little bit . . . short, or whatever, with him at the time.

245 C: I see.

246 T: You know, because I don't think this is the same student.

247 C: The next student? "He could change colors."? No, I think that's a different student too. Well, if it was the same, I would have typed Joel there.

248 T: O.K.

249 C: Well, is Joel in the spot where he's saying to himself, "What's wrong with my answer?"

The supervisor explores Wendy's frame by elaborating on the student's interpretation.

250 T: That's right. That's what I was trying to say, yeah.

251 C: And, in fact, what's right about the idea that he could change colors? Could the moth change colors? Chameleons can do that, can't they?

Ph. II Reframing
(Clue 1)

252 T: See, this is where I've questioned this myself. It's not as if . . . another child brings it up later on when she's talking . . . about uh, "Caterpillars . . . they sit on the leaves and they turn green."

Wendy explores the supervisor's frame.

253 C: Oh yes, they sit on the leaves and they turn green.

254 T: But I can see that I may have actually led them into that myself. Because of the fact that the moths didn't change color just like that type of thing.

Conclusions(2)
(Clue 3)

255 C: But you do say at one point that it's something that happened to the species, right?

256 T: Right.

257 C: On page (88), line #53.

258 T: Right, and I did mention that it took a long time.

259 C: That's right. "It takes a long time" and, "This is exactly what happened to the species of moth. Now I'm just wondering about the kids . . . Do they know that word "species?" You would certainly know if you were the regular classroom teacher.

260 T: Uhmm uhmm.

261 C: And if you weren't sure, knowing the kids better you might say, "Do you know what I mean when I say species?", or, "Do you know what I mean when I say population?" So here there might be a little potential to go into the basic underlying idea of biological adaptation. Not that you would want to do that in very much detail but there might be some kids going, "Just a minute now . . . moths can't change colors at will."

Implication(2)
(Clue 3)

262 T: Exactly.

263 C: Now, I'm sorry if I'm being too directive here. I'm a little sensitive about your time.

264 T: That's alright.

265 C: But where Joel says, "He'd probably die . . . there might be a little opportunity there for one to say, "Well, he'd probably die . . . that means he won't have any kids . . . or, I mean offspring." And I just wonder if you could get into the idea of how all these moths are there . . . they're reproducing and every once in a while one crops up that's not white . . . so that you could sew Joel's idea into

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the change of color idea. So that the kids would understand that it's not just an individual that changes color at will.

266 T: Like changing your coat, right? Or, even . . . just when I read this through, I thought that they might almost be getting the idea it's like the hare who changes back and forth according to the seasons.

Wendy reframes again, exploring the students' interpretation of the lesson content from yet another angle. (Clue 1)

267 C: Uhmm uhmm. And that has something to do with the theme of the lesson also, doesn't it? The color of the environment being an environmental factor.

268 T: Uhmm uhmm.

269 C: O.K., continuing here . . . "Can you think of any other examples of camouflage or protective coloration?" That's where you invite other examples . . . and you get just those kinds of things. Well, no . . . not really, do you? The first student says, "I think some kinds of bugs . . . some kinds of bugs blend in with the things around them . . . the environment around them." You see, even the student is kind of shaping and correcting his speech as he goes, right?

270 T: Uhmm uhmm.

271 C: "Yes, can you think of any types of bugs? Not off hand? Joel?" "Stick bugs." "Stick bugs, yes. Very good. And what's the stick bug blend in with?" "Well, the twigs." What do you think about that?

272 T: Well I go back to the first one here, where the student was talking about bugs . . . and I think again that I didn't give the child the chance to answer. "Can you think of any types of bugs? Not off hand?" And then I went to another child right away. I was . . .

Wendy shows that she is interpreting her teaching from students' perspectives quite freely now.
(Clue 2)

273 C: Do you think a little more time for that student?

274 T: Yes, definitely. However, with me standing up there I figured I'd better keep this going, right? I wasn't aware at the time that I hadn't paused long enough for it. It's pretty clear that I should have given him a few minutes to think about it.

From this student's perspective, the pause wasn't long enough to assemble an answer for Wendy's question.

275 C: Well, I think, generally speaking, that your pacing is very good. However, I agree with what you're saying. I guess it's a matter of bringing time under your own management. Like you say, when you're on your feet, a second can seem like an eternity. I think, though, as you teach more and more, you will become more aware of time . . . and what people call "wait time", that is, the time students sometimes need to reflect on a question before they can answer it.

276 T: I think Joel came up here with a really good example.

277 C: And what you suggest here . . . "Stick bugs" . . . O.K., well tell me more . . . "What do they blend in with?" And then he completes the thought, right? "Well, they blend in with the twigs." "The twigs, yes." I like that. There's a really good example of your pressing . . . right . . . and the students knowing exactly what's going on with your questioning. Would you say so?

278 T: Uhmm uhmm.

279 C: And Greg says, "The preying mantis."

280 T: And that surprised me.

281 C: Uhmm uhmm? "Caterpillars?" "Caterpillars?" Were you thinking, "Caterpillars?" These are all in the same category aren't they? Stick bugs, preying mantis, caterpillars . . . Oh, right and it was the student who suggested that they

	sit on leaves and they turn green. So there's a little bit of evidence that she is . . .	
282 T:	Unclear . . . I would say. And I noticed . . . that I should have questioned this . . . but I didn't and I just continued on. What would she be thinking? "They sit on leaves and they turn green." Uhmm, O.K. I think I should have done something more with that. Because from listening to this and reading it, I don't think she understood. Not fully. I think she realized that caterpillars are green and blend in with their surroundings . . . but they don't sit on leaves and turn green.	Again, Wendy shows that she has already reflected on this incident from the pupils' perspective. She names the implication(2) and the conclusion(2). (Clue 2 and Clue 3)
283 C:	When you say she doesn't understand . . . I'm a little fuzzy about that. She understands about environmental factors . . . in terms of protective coloration . . .	
284 T:	Right.	
285 C:	What she doesn't understand is biological adaptation . . . because she thinks that an individual organism can just change.	
286 T:	And that is my fault. I can see from going through this . . . from earlier on . . . where there was that business. He could change colors.	Wendy revisits conclusion(2) (from #254).
287 C:	Well, what was the objective of the lesson? Was it to teach the concept of biological change?	The supervisor reframes again, this time from a point of view dealing with the lesson objectives. (Clue 1)
288 T:	Well, no it wasn't. Were we not looking more at . . . basically, survival? And in order for the animals to survive, they had to blend in with their surroundings.	
289 C:	Uhmm uhmm. And the story at the beginning about the moths intended to be evidence that things . . . not necessarily individuals, but species . . . populations . . . can	Ph. III Resolve

change . . . and that there's a reason that they do change. To blend in with their environment. Even to say that they do change implies that it's something under their conscious control or something like that . . . that they change to do something. But it's really not like that at all, is it?

290 T: No.

291 C: It's just something that happens by chance really. But uh . . . well, something that happens, but it's beyond their control. Something that happens due to environmental factors. How's that for a good argument?

292 T: Good answer.

293 C: O.K., so . . . if you were the regular teacher . . . and you went home and you thought . . . you were thinking, "Now, little Darlene said to me that caterpillars sit on leaves and change green. She's confused." Well, you could always go in next period and clean it up.

294 T: Right.

End of Reflective Cycle 6

295 C: O.K. (pause) O.K., . . . Tom says something about fish: "Their bottom side is usually lighter and their top side is usually darker."

From this point until the end of episode 6, Wendy and the supervisor review a number of reflections that have occurred along the way. However, there are no further reflective cycles in this episode.

296 T: I thought that was a very good observation. Where he got that from I don't know, unless he'd looked at fish before.

297 C: Probably has.

298 T: Well, actually I think that Mr. X said some of his students had done a pond study before . . . last year.

299 C: Is that right? Maybe out at camp or something?

300 T: Yes, I don't know where but . . .
uh . . .

301 C: Of course this is only one way of doing
a pond study. You know, you could use
a pond study for any number of things.
To use it for a context with which to talk
about protective coloration is only one
out of hundreds of ways of using a pond.
But he's definitely seen fish before and
he knows that their bottom side is usually
lighter and their top side is usually
darker. Uhmm . . . sorry, go ahead.

302 T: I was just going to say that there was a
spot . . . like right there I could also
have gotten into explaining the benefit
. . . if that is the term . . . of why
the fish is lighter on the bottom and
darker on the top.

Wendy explores another possibility for completing the logic of the lesson.

303 C: I see. So getting the student to complete
the line of thought by stating the reasons
why the fish is that color.

304 T: Exactly, yeah.

305 C: Which, again, sews into the . . . the
whole concept of the lesson. Right.
How would . . . uhmm, if you could see
it written the way you would want it,
how would it sound?

306 T: Like, from there, I think I should have
asked him another question.

307 C: How would it go?

308 T: I'd probably simply say, "Well, why
do you think this is?"

309 C: O.K., I'll be Tom. "So that anything
swimming underneath the fish can't see
it against the sky, and anything swimming
above the fish won't be able to see it
against the bottom."

310 T: Right. And that would be what I would
have been looking for.

311 C: Right. And having it come from Tom would be better?

312 T: Definitely, if he was to say it.

313 C: Again, sort of along the lines that Tom counts . . . and that if it came from Tom, you would be more satisfied that the kids are with you.

314 T: Yes, that they understand.

315 C: I've got you.

316 T: Because right now, he could just be making an observation of the coloring of fish. He could have studied that. As it is, I don't really know if he understands why the fish is colored that way.

Again, Wendy looks into the bases from which students could be gathering information.

317 C: I see what you're saying. Are you getting implications for ways of developing your questioning technique out of this?

318 T: Definitely.

319 C: O.K., and . . . I think that part of learning how to teach is in learning how to listen to kids, allowing yourself to focus in on following the meaning of what they're saying. Rather than being too concerned about whether or not you have control, or . . .

320 T: Yes.

321 C: Does that make sense to you?

322 T: Oh yes. Because I found that all the way through here . . . that . . . and I think that was the reason . . . Because I do believe in listening to children and I feel that it's very important to listen to them. But I feel that I wasn't in this instance, probably because I was very nervous and I didn't want anything to happen where the class would get out of control with everyone watching me and this whole thing going on.

323 C: You were really under the gun.

324 T: So I was really aware of that and I think that's maybe why I didn't.

325 C: Again, let me say that what you did I think was just terrific. I thought it was excellent for the first time up . . . just superb. We all go through that when we begin teaching . . . the thing we're going to do is make the lesson go.

Episode 7:
PACING
This episode does not contain any cycles of reflection. Rather, the discussion about pacing is quite general, with little reference, if any, to the actual lesson.

326 T: Can I ask you a question? Would you have that problem in a normal classroom? Like, if you were teaching, could you not adjust your time? If your lesson was going to take forty-five minutes, or if it was going to take an hour and a half, and the kids are still with you, then it would be all right?

327 C: Well, does it matter if you make it through the lesson?

328 T: Well, this is it. I don't think it does. If you have some time to go on, but there's only ten minutes until the bell . . . I don't think there's any point in shoving the kids through it just so you can meet your final objective . . . and say I've satisfied that for myself, but what about the kids?

329 C: It's totally legitimate to say, "Look, we've only got ten minutes left . . . If we do this next part, we're going to have to rush through it . . . so I'd just as soon leave it for the next day. So let's sit down and we'll talk about what we did in the lesson; we could have a review of the unit; we could talk about football if you want; we can play Dog and Cat; or whatever. But to answer your question, in the practicum it's something you don't want to become a habit. You want to try to accomplish what you set out to, but, again, it's not the type of thing where if you don't you're going to get in trouble.

What I'm saying is don't let it develop
into a habit where you're spending ten
minutes at the end of each lesson
filling time. Because that would have
an effect on the kids. But, certainly
when you're on your own, you have total
control. Those are your kids and you
know exactly what they're learning, how
quickly they're learning, and so on.
All the time is under your control,
especially in elementary school.

330 T: Right. Well, again too, I can see
that . . . hopefully, if and when I ever
get to teach . . . that I will get
to know the children well enough that
I can structure my lessons so that . . .
like if you have a group of really
clever students, you can plan your
lessons accordingly. Whereas, if you're
working with . . . you know, a
slower group or whatever, you can just
scale your lessons down accordingly.
It's not going to work. That's the way
I look at it.

331 C: That's right. But your notion of
letting the lesson proceed at their rate
is really a good one. I think one of
the worst things you can do is to force
a lesson to go when it's not going.
It's like a waste of time, but it's
worse than a waste of time because it
has an effect on the kids.

332 T: Uhmm uhmm.

333 C: O.K., uhmm . . . O.K., and then the kids
get into the activity. You can see my
short cut in transcribing.

334 T: The plastic they're holding on the tape
really comes through doesn't it?

335 C: Isn't that something? I really thought
it went well . . . you know, the way
the kids set out the pond and put it
away . . . I really thought it went
exceptionally well.

Episode 8:
CLASSROOM MANAGEMENT

The discussion in this episode is also quite general in nature. Wendy does raise some implications, but these do not depend on anything that the supervisor is doing here, nor do they change in the episode. Rather, the

336 T: Yes, they did a good job with that. I know I had a real problem when I gave out my instructions to them.

337 C: What kind of a problem was that?

338 T: That's . . . down at the bottom of page (89)

339 C: Oh . . .

340 T: Forgetting to tell them where the materials were . . . and I wasn't too clear in telling them how to go about it and in what order . . . you know, I just kind of basically said, "Go to it." I didn't tell them ahead of time how to do it.

341 C: So when the student says, "How do you get them?" . . . that's what you're referring to?

342 T: No, but also the fact that I didn't say, "We're going to get our organisms . . . by taking turns and in partners . . . or whatever . . . We're going to go one by one type of thing." I noticed there was a lot of confusion amongst the students as to whether I should get up now, or it's not my turn . . . Like, I said, "Table two, would you go and get your specimens?" But I didn't tell the other students ahead of time that we'd do it by tables.

343 C: I see what you're saying.

344 T: So there was a lot of them there that didn't seem to know what I was doing and it was very clear to me at the time.

345 C: Well in this case it didn't really matter because you had the people helping, hey?

346 T: Yeah.

347 C: If you were alone in the room with

implications that Wendy raises in the discussion about classroom management are likely the result of her own reflection about the lesson before the clinical discussion took place.

The managerial point that Wendy makes here is very legitimate.

the kids it could have developed into
a problem.

348 T: But I would think that for something
else that I should explain how we're
going to go about it.

349 C: O.K. That's something, I guess, that
will come with time. Every time you
stop and think, "Well, how am I going
to give these directions?" . . . Whether
it's a science lesson or a language
lesson or a social lesson, it doesn't
matter . . . but the point is, I
suppose, that every time you do it, you
get better at it.

350 T: Hopefully.

351 C: I think it has to do with putting
yourself in the place of the student
and listening to the directions as you
give them. I think it has something to
do with logic . . . making every little
logical step clear. (pause) The kids
were excited when they saw the
organisms, weren't they?

352 T: Yeah.

353 C: Up at page (89) #75, "There's a fish
and he's camouflaged on the bottom."
It just popped out just like that,
didn't it?

354 T: I just noted down here that I probably
should have expanded a little bit more
right there. Perhaps indicating to them
to look at it from all angles . . . and
. . . uh, bring out the fact . . .
directing other students to look at the
specimens from all angles, not just from
the top. And, also, to relate it to how
this would help their survival.

Wendy recognizes yet
another opportunity to
enhance the logic of
the information presented
in the lesson.

355 C: Uhmmm.

356 T: Which I think I missed out on. At the
time I think I was more concerned with

them falling in the water or . . .
pushing each other in . . . (laughs)

357 C: And you're really taking a chance
aren't you? Was this the first lesson
you taught?

358 T: Yes.

359 C: O.K. And you've really got an activity
there where, although it's fascinating
for kids and extremely exciting, there's
a potential . . . potential disaster.

360 T: Oh yes. Like I had such visions of
what could go wrong the night before.

361 C: Well, I think it went very well and I
think you handled it very, very well.
We can look at some of the things that,
I believe, made it go as well as it did.
One of the things . . . and this is
about class control O.K.? One of the
things is that when you're speaking
. . . this is on page (89), #76 . . .
"So we have to be careful not to disturb
them by making waves." Now, that served
to control the kids.

362 T: That was a comment . . . because there
was a child on the other side of me that
was moving the edge of the pond up and
down.

363 C: Yes, I noticed that. But your discipline
technique there is very gentle, but it
communicates the message to the kids. And
she stopped making waves and there was no
more trouble with that, was there? That
little comment did its job very well
indeed. They're excited . . . and I guess
what I mean to say here is that I liked
the way you did that. You communicated
that you were aware of what was going on
and that you weren't happy with it.

The supervisor commends Wendy for her "with-it-ness" while teaching.

364 T: Uhmm uhmm.

365 C: It just took a quick little instant.
Rather than saying, "Quit making waves!"

. . . or something like this . . . it's so much better to control people inadvertently. It's almost like trickery I suppose.

366 T: It is in a way.

367 C: What we're going to do today is we're going to work in partners." Now, someone is talking here and you say, "Excuse me Dawn . . . O.K., we're going to work in partners." Listening to the tape, did you get the quickness of that? "Excuse me Dawn . . ." And then she was quiet. And then, "O.K., we're going to work in partners . . . " It was beautifully controlled. She realized what she was doing and she stopped. Then, "What we're going to do is . . ." Then some of the kids were still whispering. Of course, they're so excited about looking at these things. But your pause there on line 78 did a beautiful job of getting them to be quiet and listen. And, of course, it was important for them to listen to your directions, right?

368 T: There were so many things that I borrowed from Mr. X . . . well and from you . . . because you do them in class as well . . .

369 C: You noticed the effect?

370 T: Oh yeah, it works well. Great.

371 C: Well, that subtle way of controlling the class, in terms of discipline, I really enjoyed. I thought that was great. I've seen teachers trying to talk above their kids. You know, everybody sitting around the pond . . . and they're chattering away because they're so excited, and the teacher just goes on to give the directions.

The supervisor uses a counter example to support his claim that Wendy's discipline technique is very gentle.

372 T: Louder and louder.

373 C: Louder and louder, right. Thinking, "All I have to do is speak more loudly," Well, you could say this just as well as I could . . . What effect does it have?

374 T: The kids are just going to talk louder
too. And they're still not hearing you.

375 C: That's right.

376 T: Because of the fact . . . in this instance
that they would be so excited.

377 C: And the meta-message is that it's O.K. to
talk while the teacher's giving directions.

378 T: Right.

379 C: O.K. (pause) And then you talk about the
worksheet . . . and then Dawn starts to
talk again, doesn't she?

380 T: Yeah.

381 C: "And then if you have time . . . Dawn . . .
if you have time . . ." Again, it worked
very well. O.K. (pause) . . . so you gave
them a chance to look before putting them
to work. I thought that was nice too . . .
a little time to look and chat. And then
you get them to get their organisms and go
to their tables. Now, at this point . . .
does anything strike you at that point . . .
after the kids have had a little chance to
look, and you want them to go to their
tables?

382 T: Down at page (90), line 93, approximately.

383 C: Yeah.

384 T: Well, I can see that I should have
gotten all their attention first
. . . which I don't think I had at
that time. I paused there, but I
didn't have all of their attention.
Because I started to say, "Could I
have everyone from table two get a
partner and get your organism?" The
majority of the group did not hear
that . . . they weren't aware of what
I was saying and that's where some
confusion started to occur.

Again, Wendy comments about the necessity for all of the students to listen to her directions.

385 C: Just a little bit of confusion and I included a comment about that in the middle of the page.

386 T: Right.

387 C: Now, would that little technique that Mr. X uses . . . "All eyes on me" . . . or pausing or something, just to make sure that everybody is fixed to you at the time.

388 T: And then I could have demonstrated how to use the strainer and get an organism. Just show them how to do it. Mind you they were pretty good. They didn't seem to have a lot of problem figuring out how to do it. But I think I should have given them a quick demonstration on how to go about it . . . just for any of the kids who may have been uncertain. There may have been one or two.

She also comments about the opportunity to demonstrate how to catch an organism from the pond.

389 C: O.K. But as it was, it worked out just fine in this case because there, of course, we had other people . . . and . . . and I don't know if it was that so much as it was just the kids looking to see where the others were going to get their things. But . . . uh . . . I do agree with you that . . . that . . . uhmm . . . that could have been a little crisper at that point.

390 T: Uhmm uhmm.

Episode 9:
THE DISCUSSION OF STUDENT FINDINGS

391 C: O.K., so we get into a little discussion here . . . about a leech. "What can you tell me about the leech?" "Well it stretches out so it can move. It stretches and then it pulls itself together and . . . that's how it moves." And "What else did you notice?" And you communicate what you want, don't you, because you get it. You're looking for something about color. The student gives you the whole thing. "Well it's sort of a brownish-green so it would blend in with the muddy water." And

. . . you ask for the reason why it would be good.

392 T: Yes, I find it O.K. there, but there were several other times when I didn't expand on a point.

393 C: Now, don't be too hard on yourself.

394 T: Well, I was feeling more comfortable at this time too. I think by that time I had forgotten about the people upstairs and . . . everything else, so . . .

395 C: And so they were yours at that time hey?

396 T: Uhmm uhmm.

397 C: That's great. I think this next section flows beautifully. Let's just read over the rest of it . . . and . . . uhmm . . . and just feel free to reflect on any part of it that you want. (20 second pause)

398 T: I'm reading down here on page 92 #110, approximately.

Reflective Cycle 7

399 C: Uhmm uhmm.

400 T: At that time, as I said earlier, I sort of felt a little nervous again, once I collected the kids back again. And . . . uhmm, you know, even my phrasing . . . "What color did you say it was?" Listening to the tape . . . like, he'd never mentioned the color . . . and uhmm, whether he was aware that I was . . . wasn't listening to him, or whether he thought I was just getting him to expand more . . . I don't know. But I know myself that I wasn't listening fully to what he was saying.

Ph. I Initial Problem Setting

Wendy uses the pupil's perspective to formulate the problematic phenomenon. (Clue 2)

401 C: O.K. Of course, that's sort of a common way of requesting information. "What did you say your name was?"

Ph. II Reframing
(Clue 1)

402 T: Oh O.K.

403 C: You know . . . I know you don't know I . . . or I mean (laughs) . . . Gee. Everybody knows that he never said his name. But it's a way of requesting information.

404 T: Yeah.

405 C: So it's a little hard to say how the student read you . . . but, uh . . . But I like your concern about . . . communicating to him that you weren't listening to him. I don't think it happened in this case, but I like the way you're concerned about it. Because, of course, if you did communicate that you weren't listening, it would have an effect on him.

Ph. III Resolve

406 T: Yeah, it would. For sure.

407 C: And what would the effect be, or what would the meta-message be?

408 T: Well, like we discussed earlier. That I didn't respect his opinion.

409 C: O.K., I've got you now. "I don't count" type of thing.

End of Reflective Cycle 7

410 T: Right. (pause) The other thing I wasn't quite sure about was when they did start talking about the different specimens or organisms that they were looking at. I wasn't sure if I should correct . . . at the time, I felt I shouldn't. They called one a june bug and I just left it at that.

Reflective Cycle 8

Ph I. Initial Problem Setting

411 C: Oh . . . and you were thinking that . . .

412 T: I thought afterwards . . .

413 C: That it wasn't the june bug, but the . . . uh . . . backswimmer?

414 T: Yes, I think so. But most of the kids were calling that it so I just left it at that. I didn't see any point in . . . because it wasn't part of my lesson then. If that was something and I was the regular teacher, I could take it up with them another time, but . . . you know, I could have restructured my lesson from that point on . . . if I wanted to. In this instance I just left it. But should I have?	
415 C: Oh, I like the way you're thinking about it . . . just to leave it. You may have done a little damage to try to correct it . . . in a number of ways . . . Do you want to reflect on that?	Ph. II Reframing (Clue 1)
416 T: Well I was just going to say to correct them . . . because . . . especially in this instance since I had not made a big point of getting the correct name out. In this situation, it didn't matter what they called it. And to correct them and say, "Well no, it's not called that, you're wrong." To me, that's what you're saying . . . you're saying, "You're wrong, it's not called that. It's called something else." The kid's going to say, "Well you didn't ask me to find out the proper name, did you?"	Wendy formulates the first interpretation from the pupil's perspective. (Clue 2)
417 C: I agree. It would almost be like being too nit-picky or something.	
418 T: Uhmm uhmm.	
419 C: The other thing that I was thinking of was . . . what if it made you into an encyclopedia? You know, teacher knows all the answers.	The supervisor reframes with another interpretation. (Clue 1)
420 T: Not in this case anyhow.	
421 C: Well . . .	
422 T: But even so. What you just said I thought was a really good point. And something I sort of believe in . . .	Wendy explores the supervisor's frame, relying on personal experience. (Clue 4)

I like to see kids go in and check out some of their own answers . . . well, even myself . . . if I start looking for something I quite often get distracted . . . because I start looking at something else. There's something else there that I find as well . . . that I get excited about. That's why I never get my work done (laughs). But I think it's good for them . . . you know to go out and . . . how do I explain this.

423 C: To go out on a limb?

424 T: Right.

425 C: And to push forth a thought . . . without worrying about the nit-picky.

426 T: Right.

427 C: Well, I agree. And, of course, the whole focus of the elementary program is not so much on the content but what they call "process skills". I guess it depends on the situation, but there will be times when you're not worried about the content. Of course you need content . . . it's stupid to think about teaching process skills without content because you can't. It's logically impossible. You have to have some kind of vehicle. But wondering whether you have to have every little dent out of the vehicle . . . or not . . .

428 T: That's not so important, hey?

429 C: Sometimes you will reflect on the substance of what the kids are learning . . . and you may make adjustments here and there . . . But, at other times those will be small details. And, just like you say, you let it go. June bug was fine. (pause) You know, the meeting of the objective didn't depend on the kids knowing the right names.

Ph. III Resolve

430 T: That's right . . . in this case.

End of Reflective
Cycle 8

431 C: O.K. . . .

432 T: Uhmm, . . . and also (referring to page (92), line #118) . . . I think I cut in on him here . . . but that was because not everyone was listening. However, I should have paused a little bit further before I asked him to repeat that . . . just because . . . 'cause on the tape it's quite short. I didn't give the pause long enough for the kids to . . . to make sure that they had settled down. Mind you, they were good. There was no problem there but I figured that was something that I might extend.

433 C: On the other hand it might be good to be quick with that.

434 T: Yeah?

435 C: Before the chatter gets to the point where you'd have to make yourself awkward . . .

436 T: Oh no, what I meant was when I said, "I'm sorry, I don't think everyone's ready." And most of the students heard that and stopped talking at the time.

437 C: Oh. That's where you're saying to pause. Oh . . . I gotcha. O.K.

438 T: That's just a little technique that I think I should do.

439 C: Well is there any evidence that the kids didn't stop talking?

440 T: I think they did.

441 C: Yes, they did. I think it worked quite well . . . brought them back just like that. But you're thinking that you'd like to have just a little bit longer pause for that piece of silence.

442 T: Yeah, just a bit.

In the remainder of the discussion there seems to be very little in the way of reflection.
Wendy does raise a couple of implications for practice, but, again, these do not depend on the way the discussion proceeds, nor do they change.

443 C: So Brian says, "We had a june bug and
it had all its legs up in the front
part of its body instead of being all
spread out."

444 T: From there I was just directing him,
again to what I was looking for. For
the color. Uhmm, because the whole
lesson was on protective coloration,
I think I could have, when he did answer
me, . . . I think I should have taken a
look at the angle they're being
protected from.

Wendy revisits the notion about completing the logical flow of information presented to her students.

445 C: O.K.

446 T: Mind you, further down on #127 page (92),
. . . Ben came up with what I was
looking at. Uh, to an extent. Again,
I could have expanded on that and asked
him what effect that could have. He
said so it could blend in, but I could
have come back with, "Well, what does
that mean?", or . . . (pause) I think
they were following me . . . it blended
in as a means of survival type of thing,
you know.

447 C: And they knew some words too . . . In fact,
the term predator came from them in the
first instance, didn't it?

448 T: Yeah, that surprised me. And then down
here when I did my little speech here
(refers to page 92, #128) . . . I think
I was trying to emphasize that they change
rather than blend in . . . and, you know,
that was my problem.

449 C: O.K.

450 T: O.K., he changed because the color of his
environment changed. Whether some of them
were still on the train of thought . . .
about the caterpillar turning green when
he sits on a leaf.

451 C: I see what you're saying.

452 T: But I don't think at the time that I noticed I was having a problem with that. You know, I felt fine when I was doing it . . . the way I was doing it. It's just looking at it now.

453 C: O.K. It's interesting to consider the evidence that the kids get . . . uhmm, not the evidence so much as the reason they get for the organisms in the pond having protective coloration. These two things trying to eat each other. You know, the mayfly and the dragonfly nymphs. I just think that it's pretty nice evidence . . . that the kids saw that . . . You know, they have a reason to believe that protective coloration has a function. They see these things eating each other. I guess that what I'm trying to say is that if they didn't have evidence for a kind of trophic structure of a pond, that is, the fact that things eat each other in the pond . . . if they didn't have that evidence, then it wouldn't have really completed the lesson. Do you know what I am trying to say?

454 T: Kind of . . . sort of, but . . .

455 C: They may not have known that some water organisms eat other water organisms. You see?

456 T: O.K.

457 C: And if they didn't know that, then there would be no reason for them to believe that these things might need protective coloration.

458 T: All right.

459 C: On page (93) #140, Trish says, "I found a lake trout or a frew fish." I like the way you say, "A fry fish, yes?" . . . that's nice. Are you ever aware of that . . . when you're having a conversation with someone and you use

Episode 10:
LESSON CLOSURE
Here the supervisor makes a minor point about the way Wendy corrected "frew fish" to "fry fish."

a word . . . O.K.? And then later on in the conversation the person uses the same word . . . only correctly. Ever notice that?

460 T: Yeah.

461 C: It's a nice way to be told, isn't it? I can remember one time . . . this was in about nineteen seventy-five . . . and I was working somewhere . . . I was talking with one of the guys . . . and I used the word "orientated" . . . and this guy looked at me like I was crazy and said, "There's no such word! The word is 'oriented'."

It is interesting that he uses his own personal experience to make his case. (This is like Clue 4)

462 T: I have a friend like that.

463 C: And I've never forgotten that. Myself . . . I really appreciate being corrected the other way. That's why I say I like the way that you corrected her. Not that you would have done anything else, but I just wanted to draw that to your attention.

464 T: In this last part, I think I was struggling at the time . . . well, I know I was. And I was a little bit unsure as to what to do . . . until the bell rang.

465 C: Oh, I see.

466 T: Yeah.

467 C: Well, it worked out perfectly, I thought, in terms of time. You certainly didn't have very much time to fill.

468 T: No, no.

469 C: This is only about fifteen seconds, isn't it? Maybe a little bit longer.

470 T: But, you see I don't think that this last part had very much to do with what we were supposed to be looking at. At

that time they were sort of talking
about what they saw with the different
animals.

471 C: I thought it was a perfectly appropriate
way to end the class.

472 T: I felt very nervous again. I wasn't
sure what to do. And especially after
those announcements . . . I started
thinking . . . "O.K. . . ."

473 C: Well, you were really on the spot there.
Uh, when they speak of lesson closure
. . . I think they're speaking of
finishing the idea of the lesson
. . . the thought of the lesson.
And if you were to do it again, you
might concentrate on just sort of
reviewing what was covered in the
lesson . . . maybe having someone say
it one more time, or . . . But I really
don't think that it was really necessary
here. At least let me say that I think
we have enough evidence that shows that
the kids understood.

474 T: I think, actually, that the closure part
is back on page (92) #128 or so . . .
that's what I was trying to do there.

475 C: All right.

476 T: And then . . . you know, after I'd
gotten that out, I was just listening
to what the kids had to tell me type
of thing.

477 C: I thought it was great. (pause) Oh, I've
got a typo here. It's minnows, not
monnows. Well . . .

(The tape ends just as the Supervisor brings the analysis to a close.)